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Rural Electricity Supply.

OUR recent comments on existing and prospective regulations in respect of overhead lines in rural areas have drawn an interesting letter from Mr. R. Borlase Matthews, who was a member of the I.E.E. Committee on Electricity in Agriculture. He instances two estimates of the cost of tapping high-pressure mains which surely are outside figures in both directions; we should imagine that the lower one represents the influence of the rate of exchange, and that in order to obtain a correct impression of the cost to an Italian undertaking it should be multiplied by four. Even then it would be a modest figure.

As Mr. Matthews remarks, in this country we need some intermediate value between £300 and £14; and we hope it will be found in the neighbourhood of £50. We believe this can be done—provided that common sense is permitted to have its way, and that the alarmists are held in check. It is a constant source of wonder to us that electrical engineers, who provide the public with the finest commodity ever produced, should go out of their way to deter prospective consumers from deriving the utmost benefit from it, by hedging it about with vexatious conditions—not only with regard to the sale of electrical energy under incomprehensible and complicated tariffs, but also with regard to its subsequent use in private households; and upon the suppliers themselves is laid the burden of maintaining a standard of construction of overhead lines which can only be regarded as luxurious in these days of high prices and dear labour. Hence, when it is suggested that no rules have yet been formulated for the use of electricity on farms, and that an opportunity therefore offers itself to draw up a new and unwanted code of regulations to cover this virgin field, we fear the worst. Only one thing would set our minds at rest—an assurance that such rules would be put forward with a view to simplifying and moderating the rigour of the high-class standards at present in force. Whilst there are many thousands of farms to electrify, there is little capital available for luxuries.

It should not be forgotten that farmers have a very practical alternative to taking a high-priced supply from public mains—at a moderate outlay they can provide themselves with electric power. Oil-engine-driven sets are now so cheap, so easily operated, and so reliable, that they put up no negligible competition with public supply, and a farmer might well be excused for preferring to have plant of his own rather than enter into onerous agreements and considerable outlay which he cannot recover. With his own plant installed, he could snap his fingers at regulations. But the adoption of private plant would by no means suit the plans of the

Electricity Commissioners, who will naturally be solicitous for the load factor of the public supply; much of the farmer's work being a daylight load, and at a minimum in the winter months, its diversity would be of value to the central station. That is an additional reason for avoiding any policy which tends to impede the development of the agricultural demand on the public supply service. Moreover, the installation of small private plant would tend to restrict the development of the uses of electricity on the farm.

Turning to a different aspect of rural electricity supply, the time is now approaching when the reorganisation work of the Commissioners will bear fruit. Most of the Electricity Districts have been definitely constituted, and although only one Joint Electricity Authority has begun to function, the constitution of others is far advanced, and several Advisory Boards and Committees have been established. When they settle down to work, the conditions of electricity supply in their respective Districts will be profoundly modified. For one thing, it will be their business to see that areas at present without a supply of electricity shall be provided with it as soon as may be practicable; and, on the other hand, distributing authorities will have a right to call upon the J.E.A. to furnish them with a bulk supply of electricity, should they desire it. Thus the path will be smoothed for local authorities and companies in the areas not yet covered by statutory powers, as they will not have to face the capital cost and running cares of small generating stations; they need only lay down a distributing network, which, so far as we can foretell, will not be liable to become obsolete like generating plant—not for many years, at any rate. Capital will be readily forthcoming on such good security; certainly there will be no need for State subsidies for electricity supply, to which we are as sincerely opposed as our friends of the gas world. It is true that the extension of mains into areas which offer little prospect of an immediate remunerative return is not likely to make much progress without State aid, and the same applies to the erection of long main transmission lines interconnecting large generating stations; in these cases, following the precedent of the trunk telephone lines, the State, or the Joint Electricity Authorities, may own the mains. But that will not affect the local distribution undertakers, and we anticipate that a considerable number of applications for Special Orders will be lodged with the Commissioners as the new Authorities get into their stride.

A Directive Wireless "Lighthouse."

THE new short-wave direction-giving wireless installation which has been erected by Marconi's Wireless Telegraph Company at the South Foreland Lighthouse, and of which a description appears elsewhere in this issue, is a noteworthy development of the "beam" system of radiation, for which the credit attaches to Senatore Marconi and his expert staff. The idea arose out of the experiments which he commenced in Italy in 1916 for military purposes, using waves two or three metres in length, with parabolic wire reflectors; these investigations were continued at Carnarvon, and in 1920 an experimental revolving reflector was erected on the isle of Inchkeith, with a 4-metre wave, to act as a "wireless lighthouse." Two years later an improved reflector was installed, of which an illustrated description was given in the ELECTRICAL REVIEW of September 21st, 1923, and the South Foreland installation embodies the improvements which experience has shown to be desirable. In particular, the method of reflection adopted is quite different from that employed at Inchkeith, as will be gathered from our article, and appears to be highly efficient in confining the bulk of the radiation to a narrow beam or sector. The use of Morse letters to identify the sector of the chart in which the receiver happens to be is similar to the method adopted at Inchkeith.

On Friday last we attended an interesting demonstration of the working of the system, voyaging from Dover to Southend in the *Elettra*, and found that the signals (which on this occasion were reproduced with a loud-speaker) could be heard and identified with the greatest ease, even when they passed over many miles of land surface. With the aid of a large chart it was easy to ascertain the directional position of the yacht to a high degree of accuracy, and if a second transmitter had been in operation the exact position of the ship could have been fixed. A material advantage of the system is that signals reach the vessel every two minutes, so long as she is within a range of 100 miles (over water), so that her progress is constantly under observation.

Our congratulations are due to Senatore Marconi and his associates on the success of the demonstration, which may prove to be the forerunner of far-reaching changes in lighthouse practice.

Central American Markets.

WE review in this issue an article by Mr. R. A. Lundquist, Chief of the Electrical Equipment Division, United States Department of Commerce, upon electrical conditions in the Central American Republics as he found them in the course of a recent tour.

With the exception of Mexico, and perhaps Guatemala, very little electrical progress appears to have been made, and upon the whole even this has not been on very sound lines. Although as regards population these countries are small, they are comparatively very rich in mineral resources, particularly oil, and it would therefore appear that a high standard of life is possible. It may be that the Latin temperament retards progress, but what is being done in Spain may eventually have its repercussion in the former Spanish settlements. If and when this happens there should be numerous opportunities for sellers of electrical machinery and appliances. In Mexico, however, owing probably to the influence of the foreign capital invested in the country, much greater development has taken place. Due to its proximity, the United States has secured the bulk of the electrical business there; in 1920 American electrical exports to Mexico were valued at $4,298,223, while in 1924 the figure rose to $6,173,755. German penetration is mentioned by Mr. Lundquist, low prices and attractive credit terms being Germany's principal methods of securing orders. Sweden and Holland are also said to be doing a fair trade, the former in transformers and the latter in motors.

In the whole of the report there is no mention of Great Britain, although British capital, as well as American, has been invested in most of these countries. Nevertheless, British traders may glean information of value from Mr. Lundquist's notes, which is our object in reviewing them.

Transmission at Very High Pressure.

IN a leading article in our issue of January 23rd last, referring to the paper which Major A. M. Taylor had just read before the Junior Institution of Engineers, we commented upon the high dielectric losses of his 150,000-volt cable as described in that paper. Major Taylor has since pointed out to us that at the date of reading that paper he was occupied with demonstrating the extremely high dielectric strength tests which the cable had stood up to, and the impracticability of 3-core (non-concentric) cables for pressures above 66,000 V on account of thermal considerations, rather than dealing with the dielectric losses.

We understand that Major Taylor now claims that the dielectric losses with "intersheath" cables are no greater, for a given high transmission voltage and for a given power transmitted, than they would be with single-core, or with 3-core cables.

It will be remembered that Messrs. Clark and Shanklin, in their paper of 1919 on "Single-Conductor Cables," predicted that the contrary would be found to be the case; but, in view of the actual tests which have now been very extensively conducted on a working size of "intersheath" cable, Major Taylor suggests that their inference would certainly appear to be mistaken.

Overhead Electric Power Transmission Line Spans.

A Simple, Practical Method of Computing Sag and Tension.

By Wm. T. TAYLOR, M.Inst.C.E., M.I.E.E.

THERE is a proper ratio between the permissible span length and the size of conductor; and, for a given material, the size of conductor has more of a determining effect upon the possible length of span than any other condition. The *most economical* span length depends not only upon the material, size, and arrangement of the conductors, the weather conditions, the factor of safety, and other factors, but it also depends upon the type, height, strength, and cost of the line supports and the cost and quality of insulators.

Long spans will usually produce relatively less damaging strain than short spans. It has been the tendency for a number of years to employ long spans. This tendency came about with the employment of higher line voltages. As the insulator is the weakest part of a high-voltage line, the fewer the insulators the fewer will be the number of supports and number of points of hazard as regards both the line supports and insulators; hence there is greater economy for a given quality.

The first step in laying out a transmission span is to determine the allowable tension in the conductor. The more common problem is to determine the minimum sag at various temperatures and under normal conditions of loading to which the conductors may be strung, so that, when they are subjected to an extreme load at datum temperature, the total tension will not exceed the ultimate strength of the conductor *divided* by the factor of safety. For high-voltage power transmission lines the Regulations (in this country) specify that the factor of safety shall be 2·0; that this value shall be based on the breaking load and shall be calculated on the assumption that the line conductors are at a temperature of 22° F. and have a covering of ice to a radial thickness of ½ inch; and that they are simultaneously subjected to a wind of 50 miles per hour at right angles to the line, this wind to be taken as exerting a pressure equivalent to 8 lb. per sq. ft. calculated on the whole of the projected area of the ice-covered line conductors; the weight of ice to be taken as 57 lb. per cu. ft.

At the present time several methods are in use for computing sag and tension. The fundamental factors involved are :—

Quantity of ice per ft. of length—$0{\cdot}0218[d_1(d+d_1)]$ cu. ft.

Total vertical weight of conductor per ft. of length—
$$w_{II} = w + 57 \times {\cdot}0218 d_1(d+d_1) \text{ lb.}$$

Load due to wind pressure— $w_{III} = 0{\cdot}666\,(d+2d_1)$ lb.

Total resultant load per ft. of length—
$$W = \sqrt{[(w+w_1)^2 + (w_{III})^2]} = \sqrt{[(w_{II})^2 + (w_{III})^2]}$$

Total maximum allowable tension— $P = A\,p$ lb.

Modulus of elasticity— $E = 18{,}000{,}000$ (copper)
$= 10{,}000{,}000$ (aluminium)

Coefficient of expansion per °F—$a = 0{\cdot}0000096$ (copper)
$= 0{\cdot}0000133$ (aluminium)

Weight per ft. of length per sq. inch section—
3·935 (copper) lb.
1·195 (aluminium) lb.

where d = diameter of bare conductor, in inch.
d_1 = thickness of ice covering, in inch.
w = weight of bare conductor per ft., in lb.
A = sectional area of conductor, in sq. inch.
p = lb. per sq. inch in conductor under maximum tension.
w_1 = weight of ice per ft., in lb.

Let us take an example* and solve by means of two distinct methods to see how the final results compare with regard to tension and sag. *Example* :—A 7/·174-inch aluminium conductor is to be erected with a 300-ft. span length (supports practically on a level) to conform to the I.E.E. proposals (½ an inch ice, 13·5 lb. per sq. ft. wind-pressure, temperature 22° F., factor of safety 2·0). It is required to find the tension and sag which occur in still air at 120° F., also the sag under the ice load condition at the lower temperature.

CONSTANTS.

$A = {\cdot}167$ sq. in.	$d = {\cdot}522$ in.	$d + 2d_1 = 1{\cdot}522$ in.
$w = {\cdot}199$ lb.	$w_{II} = {\cdot}636$ lb.	$W = 1{\cdot}324$ lb.
$l = 300$ ft.	$P = 2,\ 71$ lb.	$E = 10{,}000{,}000$ sq. in.
$t = 120° - 22° = 98°$ F.	$a = 0\,0{\cdot}00133$ per °F.	$w_{III} = 1{\cdot}028$ lb.

METHOD NO. 1 (*Theoretical*).

Wherein
$$P_d^3 + P_d^2\,[(l^2 W^2 A E/24 P^2) - P] - l^2 w_{II}^2 A E/24 = 0 \quad \ldots (1)$$

and
$$P_t^3 + P_t^2\,[(l^2 W^2 A E/24 P^2) - P + a\,t\,A E] - l^2 w^2 A E/24 = 0 \quad \ldots (2)$$

and
$$P_g^3 + P_g^2\,[(l^2 W^2 A E/24 P^2) - P] - l^2 w^2 A E/24 = 0 \quad \ldots (3)$$

where: P_d = tension at datum temperature under ice loading, w_{II} *only* (no wind);
P_t = tension at a temperature, t, above datum (no wind);
P_g = tension at datum temperature, for the bare conductor, w *only*.

The sag in feet under the total loading, W, (ice and wind-pressure) is expressed :—
$$D_{limit} = l^2 W/8P = 300^2 \times 1{\cdot}324/8 + 2{\cdot}171 = 6{\cdot}861 \text{ ft.} \quad (4)$$

It can be shown—but is purposely avoided here—that in developing from the equation of the *catenary*, the first few terms of the series are sufficient to give values close enough for the closest practical working. In fact, by limiting these calculations to the second member of the series, the error in a span of 1,000 ft. is no greater than 0·0062, or 0·00062%.

Solving for P_d we have—
$$P_d = \sqrt[3]{\{2183185781 - 53^3 + \sqrt{(4366371562\,[1091592890 - 53^3])}\}} + \sqrt[3]{\{2183185781 - 53^3 - \sqrt{(4366371562\,[1091592890 - 53^3])}\}} - 53$$

and
$$P_t = \sqrt{\{124000631 - 778^3 + \sqrt{(248001262\,[62000315 - 778^3])}\}} + \sqrt{\{124000631 - 778^3 + \sqrt{(248001262[62000315 - 778^3])}\}} - 778$$

$P_d = 1581$ and $D_d = l^2 w_{II}/8P_d = 5{\cdot}941$ ft.

$P_t = 805$ and $P_t = l^2 w/8P_t = 7{\cdot}340$ ft.

These results check with those given by the British Aluminium Co., Ltd.; that is to say, the maximum limit of sag (from formula 4) is 6·861 ft., and the required sag (from equation 2) is 7·24 ft. However, the expression which they give for K is not a *constant*, because the values l and q are variable.

METHOD NO. 2 (*Practical*).—If no great accuracy is required, then, assuming that the difference due to ignoring the modulus of elasticity (E) is equal to $l_{max}\,(P - P_t)/AE = 1$ (almost), we may write

$$D = \sqrt{D_k^2 + \tfrac{3}{8}\,a\,t\,l^2} \quad \text{where } \sqrt{D^2_{limit}} = D_{limit} = l^2 W/8\,P = 6{\cdot}861 \text{ ft.}$$

wherein D_k = sag depending upon the loading conditions; D_{limit} = sag for *maximum* loading.

Therefore, we may write for this case—
$$D_d = l^2 w_{II}/8P = 300^2 \times {\cdot}855/8 \times 2171 = 4{\cdot}327$$
hence—
$$D_t = \sqrt{(D_d^2 + \tfrac{3}{8}\,a\,t\,l^2)} = \sqrt{62{\cdot}712679} = 7{\cdot}918 \text{ ft.}$$

* Using a different method to those given herein, this example is found on page 18 of the brochure "Economic Electric Power Transmission" produced by the British Aluminium Co., Ltd., London. By their method of calculation, sag $D_d = 6{\cdot}9$ ft. and sag $D_t = 7{\cdot}34$ ft.

For any material and sectional area of conductor, the *minimum* sag is expressed

$$D_{min.\ (limit)} = l^2 w/8\,P = l^2\,\delta A/8\,AP = l^2\,\delta/8P;$$
where $\delta = 1{\cdot}198$, and $P = 13{,}000$.

For aluminium stranded conductor this may be written: $0{\cdot}0000114l^2$; for this case we have—

$$D_{min.\ (limit)} = 0{\cdot}0000114 \times 300^2 = 1{\cdot}026 \text{ ft.}$$

From the values of sag obtained by this simple practical method we see that the required sag checks close enough to warrant its employment. It is a method largely used in this country, and is within fair practical accuracy provided the temperature range is kept within about 60° F., which value approximates the usual stringing temperature. For the higher temperatures and for certain problems, the value of D as obtained by this method cannot be relied upon. Method No. 1 gives results to a high degree of accuracy.

The value D_t given by the British Aluminium Co., Ltd., as obtained from the stress A_{P_1} (lb. per sq. in.), in which the loading is Q_1 is found from the equation:

$$P_1 - l^2\,Q_1^2\,\delta^2\,E/24\,(P_1)^2 = P - [l^2\,Q^2\,\delta^2\,E/24\,(P)^2] - a/E$$
$$D_t = l^2\,\delta\,Q_1/8\,P_1$$

Wherein $P = P/A$; $Q = W/w$; $\delta = 1{\cdot}198$ for aluminium.

The Design of Squirrel-Cage Motor Starters.

Suggestions for Alterations Necessary to Meet Heavier Load Conditions.

By J. O. KNOWLES, M.A.

A RECENT article in these columns (ELECTRICAL REVIEW, May 22nd, page 805, "Motor Starting Equipment," by F. W. Davies) suggested that "finality had not yet been attained" in the design and standardisation of a.c. starting gear. The writer feels, however, that the remarks made in that article on the design of three-phase starters could be considerably amplified, and that the increasing use and possibilities of large squirrel-cage motors call for increased attention to the design of large squirrel-cage starters. The objections to the use of large squirrel-cage motors are disappearing as the power reserves immediately behind the supply mains are also increasing. The surges of current that, in a small feeder circuit, would cause such a fall in pressure as to trip the neighbouring circuit breakers and cause all the lights to flicker, will make little disturbance in a feeder of ample dimensions near a sub-station of large capacity. On the other hand, the same reason that enables squirrel-cage motors of large horse-power to be used makes the duty of the starter more severe. Not only must a large current be interrupted on the starter contacts, but the energy in the interrupted circuit is supported by a large reserve of power in the feeder and the sub-station behind it.

It would be a pity if the use of squirrel-cage motors for increasingly large horse-powers were retarded by backwardness in the design of squirrel-cage starters, for the simplicity and cheapness of their design reduces the cost of electric power and so benefits, among others, the electrical industry itself. Yet there is a considerable prejudice against the squirrel-cage motor, not among the smaller engineers who are apt to regard maintenance expenses as "all in the day's work," but among engineers responsible for large installations, who cannot afford to tinker with inefficient apparatus.

Remembering, then, that the troubles that are annoying in small squirrel-cage starters are likely to be serious in installations of large size and of large horse-powers, it is only reasonable to expect that the design of squirrel-cage starters will improve up to a higher standard.

What then are the weakest features of the present designs which are likely to give trouble under severer conditions? No attempt is made in what follows to arrange these weak points in order of importance, as the order would vary for different makes of starters. Neither need any mention be made of those obvious features which are commonly found in the good makes at present.

Consider first, however, the damage that an unskilled operator can do. He cannot start a star-delta starter in delta without passing through the starting position, but some men have such a wholesome fear of electrical gear that they are half-afraid of a starter that lets the motor speed up with a rush. These and others, more cautious if less fearful, attempt "inching" the starter to make sure that everything is all right. In other cases "inching" may be really desirable at the commencement of the process, but a squirrel-cage motor may have been supplied, and the operator acquires a certain amount of "skill" in "inching" on the squirrel-cage starter, to the detriment of the contacts. A control-gear maker must expect that his starters will sometimes be operated by clumsy and ignorant labourers and sometimes by over-'cute mechanics. He can, of course, say that it is not his fault if his starters break down under such usage, but it is better for his reputation if his starters are designed to resist or prevent such ill-treatment. Unlike high-pressure switchgear, motor starters are operated by all classes of labour, from the lowest upwards, and as the control-gear maker is probably a sub-sub-contractor, his knowledge of the conditions under which his starters will be used is probably even less than that of the sub-contractor who decides the placing of the order for the starters. Is it not, therefore, desirable to have a quick-make action in the starting position of squirrel-cage motors? There is considerable scope for variation in the design of this feature, inasmuch as few, if any, makers now provide it. A nearly perfect form is a cam with a steep rise or a strong star-wheel action, either of these forms compelling a considerable pressure on the handle, which pressure is naturally maintained for the necessary instant after the restraining pressure is replaced by the resistance of the contact springs, so that a decisive closing of the contacts is almost inevitable. An alternative is the use of a separate contactor type of circuit breaker operated electrically from the starter. This scheme, although it provides both free-handle action and a quick make, is expensive in small and medium sizes. Fortunately, however, the larger sizes are those in which the necessity for a quick make is likely to become more prominent in the near future. Apart from electrically-operated contactors, it is possible to ensure a quick make by compressing a spring which, when released, closes the switch, but in this case the switch handle should necessarily in the larger sizes follow up the action of the spring so as to ensure a good contact.

The change-over from "start" to "run" should be similarly a quick-make-and-break action independent of the operator. This movement should be designed primarily for the auto-transformer type of starter, as the severity of the break will then be greatest. The upper limits of size for which the drug type of switch is suitable can best be tested on these change-over contacts by repeatedly switching on the motor through the transformer and by changing over with insufficient intervals of time. That there *are* limits to the drum-type change-over switch will then be tested, and this

is generally agreed, but the limit of suitability is still largely a matter of opinion. For large currents, however, as for high pressures, the drop-switch form is easier to construct in a sound manner, *i.e.*, with ample head of oil deepening as the break increases. The contacts themselves may be formed as wedges (see fig. 1), in which case the arcing point of the wedge should not be in contact when the switch is "on," or butt contacts

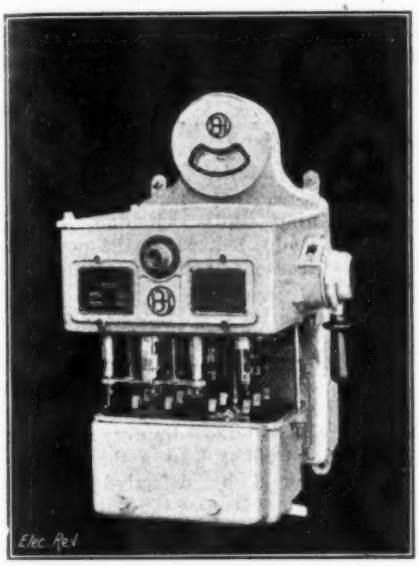


Fig. 1.—A Brookhirst Drop Switch Straight-on Starter for Medium Horse-powers—Wedge Contacts.

(see fig. 2) may be used in conjunction with a drop-switch action.

Again, the matter of no-volt and over-load protection becomes of increasing importance with the increase in the size of units. The burn-out of a small motor because of some trivial failure in the protective features is annoying, but a similar failure in a 100-h.p. or a 200-h.p. motor through a trivial detail is more than annoying—it may be so costly as to give the user a prejudice against the manufacturer of the faulty starter for years or for ever, while a stoppage due to a burnt-out no-volt coil may cost more than the value of the starter.

Consider first the no-volt feature. The ordinary requirements in a good design are that the plunger should always move home without sticking, that the no-volt catch should be sensitive without being either so weak as to open under vibration or so strong as to fail to open when required, and that the coil itself should not get so hot as to burn out or warp the plunger guide. In future, however, there will be more need of a no-volt release which will not operate if the pressure dies down momentarily to, say, 33 per cent., or even 25 per cent., of the normal voltage due to a heavy short circuit in some adjacent part of the system. Otherwise a breakdown of one supply may throw out of action a whole sequence of motors in another section (*e.g.*, the auxiliaries of a boiler house or of a paper-making plant), and restarting may cost money and be very inconvenient. It is not a bad idea to be generous in giving space to the no-volt coil frame so that unusual specifications such as the above can be met without an excessive temperature rise.

The adjustment of over-load releases becomes a more serious matter as the horse-power of the motor increases. In spite of the robustness of the modern motor, it is not immortal; repeated overheating for prolonged periods eventually breaks down the insulation. Speaking of the squirrel-cage motor only, the starting peak current is fairly innocuous. On the other hand, there are many applications where the motor can be run for considerable periods (intermittently) to 25 per cent. or 50 per cent. over-load without the knowledge of the electrical engineer, who is then likely to blame the motor maker. The latter should blame the starter manufacturers more often than he does. There is still too great a tendency to regard the robustness of the squirrel-cage motor as an excuse for poor over-load protection; thus over-load releases are provided with time lags which, in hot weather, will only hold them down during starting by screwing down the overload calibrator to trip at a high figure. Then the motor has inadequate protection during running, and might be overloaded for long periods without anyone being the wiser—till repair bills began to mount up. In some circumstances such long period over-load conditions are, of course, impossible, in others improbable, but, as before mentioned, the control-gear maker must standardise on a design which will stand up to conditions which may reasonably be expected in a fair proportion of cases where this standard design is to be used.

Again, it is too usual to cut the overload releases out of circuit in the starting position. If there is one time when a short circuit is likely to occur, it is at starting up. The sudden rush of current during starting completes the insidious breakdown of insulation, or the usual "accidental" short circuit or crossed connection in connecting up, or even a spanner dropped in the wrong place—all these faults are discovered when restarting. If the overload releases are cut out of action during starting, there is either an expensive firework display while the operator continues to hold the starter handle in the "start" position, or the main fuses or main breakers open and other plant is also shut down.

A simple solution of the over-load problem is to lower the over-load cores during starting and until the running kick has died down. In this way the overload release will act on 400 per cent. to 500 per cent. overload during starting; but without fitting any dashpots at all, the releases can be set to trip even as low as 25 per cent. above normal current during running conditions. If this lowering of the over-load cores is done automatically from the starter handle, the device is made foolproof (see fig. 1).

There used to be a "rule of thumb" that read "straight-on starting to 3 h.p., star delta to 25 h.p.,

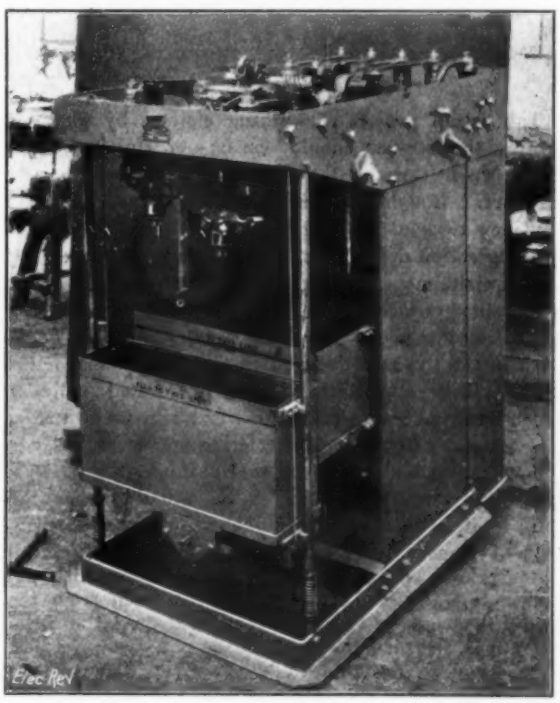


Fig. 2.—A Transformer Regulating Switch—Butt Contacts.

auto-transformer to 50 h.p., and wound rotor motors above 50-100 h.p." Like most time-honoured rules, it is not a bad guide, but times are changing—and designs. Perhaps the most important development of squirrel-cage motors is the adoption of high-resistance rotors, so as to increase the rotor resistance during

starting. This has been done in various ways by different motor manufacturers, but the result is just what is wanted to improve the starting conditions in the squirrel-cage motors.

The efficiency in running is usually slightly less than in the normal motor (granted that this slight difference means money if the motor is run continuously day and night). Here, then, is a squirrel-cage motor which can be started by a simple starter, but which gives a good starting torque without excessive current kicks. The reactance effect can be designed for different conditions. If frequent starting is required against heavy torque, the reactance effect is made full use of at a loss in efficiency which makes this type truly economical only for motors on somewhat intermittent duty. If the starting torque required is not so severe the efficiency can be improved.

Here at least is an avenue for improvement which will also call for improved designs in large squirrel-cage starters. For intermittent work a simple straight-on starter will be required for larger powers than at present, and such starters will lend themselves easily to automatic control. Thus a float switch, push button or tappet switch may operate a simple contactor, air-break or oil immersed, with over-load releases for protection, the latter having a restraining device similar to that above described, to allow for the surge in starting. For reversing work a quick-make-and-break hand-operated reverser with a separate protective panel or a combination of contactors with master switch may be used, as a motor having this automatic starting reactance can be reversed even at full speed without electrical injury.

Then again there is the matter of speed control for which wound-rotor motors with wasteful expensive rotor regulating resistances have been used of necessity and not of choice. Consider a fan drive, for instance. To a certain extent the draught can be throttled down mechanically, using a constant speed motor.

For greater speed variation, why not use a two-speed motor with two stator windings and a squirrel-cage rotor? Such a motor can be started by straight-on, star-delta or auto-transformer starting on the lower speed and then switched over for the higher speed. By using also simple pole changing, three or four speeds can be obtained. By using the drop-switch type of starter the whole of the starting equipment can be made into a compact unit, including circuit breaker protection, correct-sequence operation, and automatic over-load restraining while switching, the over-load calibrations being adjusted, where the powers vary on the different speeds, to suit the capacities of the two stator windings.

Such are some at least of the possibilities of the squirrel-cage motor of the future. Other features may be invented to fill up the gaps in the applications of the types mentioned, especially if the supply authorities take a broad-minded view. At the same time the control gear must keep pace with these improvements so that the repeated complaint that at least a third of the motor breakdowns are caused by defective starters may be made less and not more true as the duty of the starters becomes more severe.

Choosing and Using an Electric Washer.

Diary of a User's Experience.

By "WREN."

(*Concluded from page* 368.)

The Washing Action.

The actual process of washing clothes, by whatever means, consists—or should consist—of sluicing warm soapy water through the fibres to loosen and remove all dirt. Rough treatment is destructive, and any tendency to close packing of the clothes obstructs the washing action described above. In the machine washer the requisite movement of the clothes through the water is obtained *either* by a "dolly" with a reversing rotary motion about a vertical axis, the clothes being loose in the tub and dragged to and fro by the dolly; *or* by placing the clothes in a perforated cylinder which has a reversing rotary motion about its own axis, this being horizontal. The relative merits of the two systems are a matter of personal opinion, the writer's view being that the "dolly" is somewhat rougher and more local in its action than the cylinder.

The cylinder, being provided internally with radial battens, is supposed to engage sufficiently with the clothes to pull them through and lift them from the water, then letting them fall back into the latter from the upper part of the cylinder as the drum rotates. This action, we were told, could be observed in a machine fitted with glass drum and container ends. It would surely be an effective piece of salesmanship to have a demonstration machine thus equipped in every showroom.* Given this facility the prospective purchaser would be convinced at once of the efficacy, or otherwise, of the washing action, and he (or she) would be able to decide whether the principle of six revolutions forward and six reverse is better, or worse, than that of reversal at every revolution—a point, by the way, on which the writer has been unable to obtain convincing evidence or opinion. From first principles it would seem that reversal at each revolution gives maximum sluicing action and does not permit any "packing" of clothes by centrifugal force.

In some cylinder machines the oscillating drum is made of wood, and in other cases metal is employed. Here, again, it is largely a matter of personal preference, and it would be good policy for makers to supply either a metal or a wooden drum according to the purchaser's desire. Only in one or two instances has the writer been given this option.

The points to be looked for in any washer-cylinder are strength, balance, smoothness, and adequate perforation. If possible, a demonstration machine which has seen a fair amount of service should be examined. Wooden cylinders should be inspected for any signs of warping, and the method of attaching the side-pieces (*i.e.*, the cylinder walls) to the ends of the drum should be examined carefully to make sure that there is no tendency for the drum to come to pieces. The holes in metal cylinders are generally, but not always, guarded against sharp edges by counter-sinking and/or some form of beading. Any sharp edge, roughness, or projecting screw, &c., has disastrous consequences. A liberal provision of perforations is desirable to secure a free flow of water into and from the cylinder. Any tendency to form scum or slime on the cylinder parts should be regarded with suspicion. There should be no parts in the container or cylinder which can rust.

* Since these lines were written, the writer has found one demonstration machine fitted with glass windows to allow the internal action to be observed. Such machines are not, however, generally available. The maker of every electric washer should surely arrange that all his demonstration machines can be seen inside and out whilst in motion.

Six Months' Experience.

After concluding the preceding paragraph a machine was purchased, and it has now been in use for over six months, to our entire satisfaction. In the words of the writer's wife, we "would not part with the machine for anything." Not the slightest mechanical or electrical trouble has been experienced, and on several occasions during the spring a day's washing at least three times as heavy as could have been done by hand was accomplished with less fatigue than that entailed by an "ordinary wash-day" before the advent of the electrical machine.

The only mishap has been the blowing of a fuse owing to clothes sticking to the rollers of the wringer and "winding in." The rubber rollers, working under high mechanical pressure and at high speed, compared with a manual wringer, are very apt to carry round a few threads of frayed material, or a tape, and once the strands re-enter the front of the rollers the whole of the material follows and the safety pressure-release must be tripped promptly to prevent jamming. If jamming occurs, the only consequence (with our machine) is that the fuse is blown. Replacing the fuse is less trouble than extracting the wound-on clothes, if the latter be jammed tightly. On the only occasion when this occurred with our machine, a large piece of rough canvas with many loose ends was being washed; it jammed between the bottom roller and the frame so tightly that it had to be cut and picked out piecemeal. Obviously it is as well to practise the use of the wringer with some material of no value!

No trouble has been experienced with the washer itself, and the only attention required has been occasional lubrication. This is, of course, essential and must be done periodically and with suitable oil. The gears are grease-packed, but there are half a dozen bearings with small oil cups which need attention every fortnight or so.

During the damp weather an unpleasant mould grew on the wooden battens of the washer drum during the week owing to the wood being shut up, whilst damp, in a confined space. In summer time the wood dries completely in a couple of hours, if the drum be stood out of doors, but no method has been found for avoiding the mould in winter save by leaving the cover off the machine. Possibly hinged brackets which would hold the cover open 2 inches or so would provide sufficient ventilation to keep the wood sweet, whilst still permitting the cover to be used as a table. The tendency for mould to grow on wood seems to be a distinct argument in favour of all-metal drums.

Comparison of Costs.—The following comparison of costs is a thoroughly representative one, made after the machine had been in use for three months. The articles washed included household linen of all kinds—everything that requires washing in a household of five persons, with the exception of starched collars. Price schedules were obtained from four laundries, and it was found that the minimum charge for the articles in this wash would have been £1 4s.; at two of the laundries the charge would have been considerably higher.

The actual total cost of the wash when using the electric washer and an electric iron was 2s. 0½d., made up as follows:—Soap, 1s.; starch, 2d.; hot water, 2d.; electricity for washing machine, 3d.; electricity for electric iron, 5½d. To these items must be added the capital charges on the machine; allowing 5 per cent. interest and 10 per cent. depreciation on £50 (the first cost of the machine), we arrive at £7 10s. per annum or, say, 3s. per week. On this basis the above-mentioned wash would cost, at home, 5s. 0½d. per week—a saving of 19s. a week as compared with laundry charges, so that the first cost of the machine would be saved in $50 \times 20/19$ or 53 weeks. If no allowance be made for the capital charges, and it is hardly necessary to do so when the whole outlay is recovered so quickly, the first cost of the machine is saved in $50 \times 20/22$ or 45½ weeks.

In order to meet any possible criticism of the cost items stated above, the following explanations are added: Plenty of soap is essential for satisfactory results; the amount of water in the machine is small, but it must be very "sudsy" if the best and quickest washing is to be obtained. The allowance of 2d. for hot water may appear to be low; actually it is ample. The writer has an anthracite stove which costs 1s. 5d. per 24 hours (coal at 85s. per ton), so that the total cost of fuel for three hours, *i.e.*, the duration of the wash considered, equals 2.1d. By charging 2d. to the washing bill we are on the safe side, because during this period two radiators were in full operation, and waste heat from the stove was helping to warm a cooking oven. The actual consumption of electricity by the machine during three hours was 0.425 kWh, costing 2.975d. at 7d. a kWh. A 400-watt electric iron used for two hours consumed 0.8 kWh, costing 5.6d.

The amount of dirt extracted from clothes the first time they are put through the electric washer will be gratifying, or humiliating, according to the way one regards it! In making the above comparisons of cost, no allowance has been made for the fact that clothes last much longer and are a much better colour when washed at home than when sent to a laundry, but this is a consideration of real importance. Clearly the electric washer, even at £50, is a splendid investment, but it is not everyone who can afford the initial outlay. To meet their case there is surely a sound argument for the sale of electric washers on easy payment terms. The amount saved on the laundry bill is so considerable that the instalments needed to pay for the machine in, say, two years still leave a net reduction in the weekly expenditure of the household.

In preparing these notes the writer started with an open mind and has endeavoured to preserve an unbiased attitude throughout. That he is now an enthusiastic believer in the electric washer goes without saying, and it is hoped that these notes will induce others to invest in these machines. The central station engineer who omits to encourage electric washers by every means in his power will be losing a valuable opportunity for, whilst the actual energy consumption per week is less than that of a 40-watt lamp used five hours a day, invaluable service is rendered by the washer in advancing the cause of electricity in the home. Prospective users of electric washers may have every confidence in the utility of these machines, and the writer's experience may assist them in their choice. Perhaps, too, actual and prospective makers of electric washers will not consider these notes unworthy of consideration.

Low-Temperature Coal Carbonisation Installation.—What will be, according to *Power*, the first low-temperature coal distillation system of its kind to be installed in America, is to be erected at the Lakeside plant of the International Combustion Engineering Co. of New York. It is said to have been perfected after more than two years of experimentation at the Lakeside power station. The initial plant will provide for the treatment of at least 210 tons of coal per day, or about one-fifth of the plant's present requirements. The coal is pulverised before being heat treated, and the oils, gas and other residuals are recovered under low temperature. This leaves the coke in such a form that it can be readily burned in a pulverised-fuel furnace, and, it is claimed, with certain advantages over the burning of pulverised raw coal.

A description of the process appears on pp. 412-3 of this issue.

Thawing Meat Electrically.—A demonstration of an Australian electrical invention for accelerating the defrosting of imported meat took place recently at the Poplar electricity works, when Australian beef was defrosted in 23 hours. The inventor, Mr. A. U. Alcock, of Melbourne, explaining the process to a *Daily Mail* reporter, is reported to have said: "The beef is hung from a hook which carries the controlling device for securing a uniform flow of electricity through the whole piece of meat, so that in less than 24 hours the temperature can be carried from 20 deg. to 35 deg. F. at the bone, thus eliminating all ice from the meat. At present, defrosting in the ordinary atmosphere takes three days in summer and six days in winter, so that the butcher has to order a long way in advance and wait for the meat to thaw. With the new device he simply turns on the ordinary alternating current in his shop and the process is complete in 24 hours at a cost of 6d. for hindquarters of beef and in 8 hours at a cost of 2d. for mutton." It is claimed that under the electrical treatment the meat retains the original flavour and weight much better than under the atmospheric method, and that the quickness of the process has many advantages in cleanliness and economy for both the butcher and the consumer.

Pilot-Wire Control for Street Lighting.

By A. C. JOHNSON.

In his paper on "Street Lighting," read at the Brighton Convention of the I.M.E.A., Mr. Haydn Harrison points out that scientific lighting has recently made great strides, and that further improvements must be looked for in a decrease of the capital and operating costs incurred in switching, which costs—at any rate in side-street lighting—form such a large proportion of the total costs.

Even after making allowances for extra current and lamp renewals, hand switching still holds its own and remains generally a cheaper method of control, and certainly a more reliable one, than time switches the use of which is often confined to isolated districts and scattered lamps.

The only capital outlay for hand switching is that of the switchgear, and the annual costs per 100-watt lamp are approximately as follows, depending on local conditions and wages, *viz.* :—

Loan charges on switchgear—10 per cent. of 17s. 6d.	£0	1	9
Labour on switching	0	12	6
Extra lamp renewals due to additional 456 hours over schedule lighting hours	0	1	9
Extra energy—46 units at 1½d. ...	0	5	9
	£1	1	9

The loan charges on time switches are often taken at 20 per cent. In the following comparison with hand switching, I have assumed that the time switch has an average life of 10 years:—

Loan charges on time switch—13 per cent. of 65s.	£0	8	5
Loan charges on switch casting and fuse—10 per cent. of 17s.	0	1	8
Winding, attendance, and minor repairs on site	0	8	0
Repairs and overhauling	0	3	0
Extra lamp renewals due to additional 270 hours over schedule lighting hours	0	1	0
Extra energy—27 units at 1½d. ...	0	3	4½
	£1	5	5½

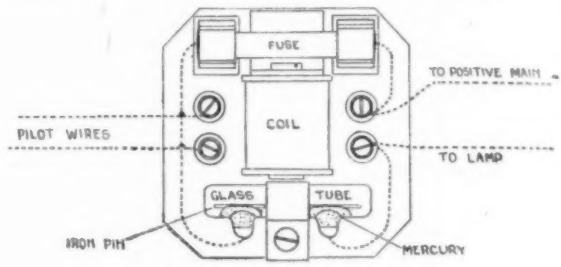
The pilot-wire control has many advantages over other systems of control. It is perfectly reliable in that a fault on the pilot wire automatically lights up the street lamps and cannot, therefore, plunge the streets into darkness. The lamps being controlled from one control station situated anywhere on the network can be switched on at exact schedule lighting hours and there is no waste of either current or lamps. In the event of fog or storm, the lamps can easily be switched on before schedule time. Time switches entail extra burning hours of from 40 to 60 minutes per day for various reasons, amongst which the following may be mentioned, *viz.* :—

1. The vagaries of clocks.
2. Allowance for occasional dull weather and storms.
3. The clock is usually wound once a fortnight, during which time the lighting hours vary as much as half an hour at night and half an hour in the morning, but light must be provided for the longest night.

A description of the pilot control system will be found in the ELECTRICAL REVIEW dated April 24th, 1925, and the accompanying figure shows a simple and weatherproof combined relay switch and fuse constructed so that it can be inserted in any standard street-lighting switch casting provided, of course, that the hand switchgear has been previously removed; therefore, a change-over from hand to pilot control does not entail a heavy expenditure on switch castings.

Further, the relay illustrated only entails an annual consumption of about 1 kWh.

The cost of installing the pilot system of remote control depends largely on the cost of the pilot wires laid in the ground. When new service mains are laid, a pilot wire can be incorporated with the lighting cable at a small extra cost of approximately £3 per 1,000 yards. Overhead wires on traction poles and wires drawn into existing underground ducts can also be laid



Combined Relay and Fuse.

at a small cost. If, however, there are no ducts and special armoured cables have to be laid, the cost is higher, but as loans for cables are generally borrowed for a period of 25 years, the total annual charges are still lower than with hand switches even when the cable is laid under made-up paths.

100-WATT LAMPS (40 YARDS APART).

—	One or two wires.	Cost of pilot wire laid.	Cost of relay switch fuse and switch casting.	Loan charges on cable at 7½%.	Loan charges on switchgear at 10%.	Repairs and maintenance of cables and switchgear.	Total per lamp per annum.
		£ s. d.	£ s. d.	s. d.	s. d.	d.	s. d.
New lighting mains laid & 1/18 S.W.G. pilot incorporated	One	7 6	1 0 0	7	2 0	6	3 1
	Two	10 0	1 0 0	9	2 0	6	3 3
Armoured pilot laid direct in ground in open trenches	One	2 15 0	1 0 0	3 11	2 0	6	6 5
	Two	4 7 0	1 0 0	6 2	2 0	6	8 8
Armoured pilot laid direct in ground in unmade paths	One	4 5 0	1 0 0	6 1	2 0	6	8 7
	Two	5 17 0	1 0 0	8 4	2 0	6	10 10
Armoured pilot laid direct in ground in slabbed paths	One	7 5 0	1 0 0	10 4	2 0	6	12 10
	Two	8 17 0	1 0 0	12 7	2 0	6	15 0

The accompanying schedule gives the approximate annual costs incurred by the pilot control system, assuming 100-watt side-street lamps situated 40 yards apart.

Laying C.T.S. Cables Underground.—The use of C.T.S. cables has been extended in some cases to underground mains. Owing to the comparatively high cost of C.T.S. this is not a general practice, but it is sometimes convenient for connections between houses, stables, &c. Trouble has occasionally been reported on C.T.S. cables laid underground, which, while it has been put down to the cab tire sheathing being affected by the action of the soil, has, on inspection, in every case been found to be due to sharp stones, &c., being driven through the C.T.S. by the use of the usual heavy earth rammer used for consolidating the trench. After such experiences it has sometimes been arranged to lay boards, tiles, or bricks over the cable, but this is an expensive measure. One method of effectively protecting such cables at the minimum of cost consits of cutting out a small rebate at the side of the trench, and pushing the cable into it; the usual filling-in and ramming process can then be carried on without any fear of damage to the cable, as it is effectively protected from the rammer in its little cave. It is claimed that earth does not affect C.T.S., and the claim is based on many years' experience of such cables laid in a rose garden, which, of course, is well manured land.

Some Notes on Individually-Driven Textile Machinery.

The Importance of Low Rating and High Starting Torque.

By A. HAIGH, B.Sc.

THE question of "Individual electric driving of textile machinery" *versus* either electrical group driving or engine-driven mills has received a large amount of attention, and most of the advantages and disadvantages are now generally understood. The two chief advantages of individually-driven machinery are absence of cyclic variation and reduced risk of a complete "shut down." The former means a more uniform quality of material produced, and in such machines as ring spinning frames fewer breakages of yarn. These advantages are easily understood by mill owners, but in many cases the question of first cost weighs very heavily against individual driving. It cannot be disputed that in every case the first cost of individual motors is more than for group driving, and unless it can be clearly demonstrated that this additional outlay justifies itself, manufacturers cannot be expected to scrap existing systems in favour of an individual motor for each machine. The purpose of this article is to show how the initial expenditure on an individually-driven installation may be kept low, and also justify its use in low running costs and improved production. The statements made are essentially applicable to a cotton preparation and spinning mill, though they can equally be applied with small modifications to any other textile processes.

If the cost of an installation is to be kept low, the motors used must have a rated output as low as possible consistent with efficient running. This fact would at first sight appear so obvious as not to deserve any consideration, but in many installations, motors with rated outputs of anything up to 50 per cent. in excess of normal requirements are used for various reasons which will be discussed later. Textile machines, particularly ring spinning frames, require a starting effort greatly in excess of full-load torque to ensure reasonably quick and steady acceleration to full speed. This is particularly the case on Monday mornings in winter, when the frames have been standing all the week-end and the viscosity of the oil is rather high. The starting torque required is in the neighbourhood of from two to two and a half times full-load torque. To overcome this difficulty, one of two methods is usually employed, and quite often both. These are the installation of motors of a higher rating than is required for normal running, and the use of centrifugal couplings to allow the motor to run partly up to speed before taking the load from the frame. Both of these methods are costly, and they are not necessary.

The extra cost of centrifugal couplings over the standard leather disk flexible type is in the neighbourhood of £4, while the increased cost of motors of higher ratings than necessary may be anything from £5 to £10. Ring spinning frames of average length require from 4 to 5 h.p. to drive them, but the starting effort is between 10 and 12 h.p. If therefore standard motors capable of accelerating against a load of about 1½ times full load are installed, they will require to be at least 7½-h.p. machines. They will then be running for most of the time at two-thirds full load with a power factor and efficiency much below their performance on full load. If this method of overcoming the difficulties of starting is employed, not only is the initial expenditure higher than need be, but the running costs are also considerably increased. The only objection to centrifugal couplings is their cost. It must be admitted that they perform their duty quite well.

The first requirement therefore for textile motors is high starting torque. All motors up to 10 h.p. should be capable of exerting a starting torque of 2½ times full-load torque. This can be achieved without any undue sacrifice of power factor, efficiency, or speed, as will be shown later by tests on actual motors. If motors possessing this characteristic are employed, they will not require to be of a higher rated output than the average power required to drive the machine. Furthermore, flexible couplings of the type already described can be used in place of centrifugal couplings. Under these conditions the breakages of ends will not be found to be in any way excessive when starting the frames, provided the rings are always moving in a downward direction, as is usual. It must, however, be admitted that the strain on the rotor joints on starting is greatly increased, but if due precautions are taken in the mechanical design of the rotor, no trouble will be experienced. The necessity of textile motors having high starting torques cannot be over-emphasised, and sufficient attention has not been paid to this point by many motor manufacturers.

The second requirement of textile motors is low temperature rise. Enclosed ventilated machines with perforated covers over openings are not entirely satisfactory, as there is a tendency for the openings to be seriously contracted due to "fly" adhering to the perforations. There is no doubt that totally enclosed machines are preferable for this class of work, but often their increased cost prevents their use. There are, however, on the market, types of motors which, though their windings are totally enclosed, yet have a system of cooling not unlike surface condensers. This keeps down the size of the motors, and the price is not greatly in excess of that of enclosed ventilated machines. Though their first cost may be higher, the running cost is reduced, as they do not require cleaning more often than about every two years, whereas protected type machines have to be cleaned about every six months. This saving can easily amount to ten shillings per motor per year. From the point of view of upkeep charges, ball and roller bearings require far less attention than ring lubricated sleeve bearings, and for this reason alone they are preferable.

For individual motors to compete with group driving in keeping down running costs, they must have high power factors and efficiencies. The improved quality of electrical steel, and the use of ball and roller bearings, have made it possible to obtain performances which at one time would have been thought impossible. The accompanying table gives performances obtained on test

Rated output of motor B.H.P.	Full load.			Starting torque. % of full load torque.
	P.F.	Efficiency.	R.P.M.	
1·0	·85	84%	960	260%
1·5	·88	87%	970	290%
2·5	·89	89%	970	300%
4·0	·89	90%	970	270%
5·0	·89	90%	970	260%
10·0	·90	90%	975	255%

Actual performances of squirrel-cage induction motors, 3-phase, 500 volt, 50 cycles, 1,000 r.p.m. (syn.).

on a number of small induction motors. In each case they are 3-phase, 500-volt, 50-cycle, 6-pole machines. It will be noticed that these motors have an average power factor about 4 per cent. greater than most commercial machines, while their average efficiency is about 5 per cent. higher. The saving in power by their use is considerable and well worth the extra first cost entailed. The money value of increased power factor is

difficult to determine, as, if power is bought in bulk, there may or may not be a penalty and bonus clause relating to power factor. On the other hand, the power may be obtained from a generating station at the mill. It can safely be assumed that the 4 per cent. increase in power factor is equivalent to 1 per cent. gain in efficiency in most cases. The total gain by using high performance machines is then in the neighbourhood of 6 per cent. in efficiency. On 1,000 h.p. of motors, working at full load for, say, 2,200 hours per year, with energy at one penny per unit, the saving is over £60 per annum. The cost of high performance machines is about 5 per cent. greater than that of ordinary motors. Therefore if the latter cost, say, £5,000, the additional outlay for high performance machines would be £250, and would bring in a return of £60 per annum or nearly 25 per cent. The above estimate has been made out on a conservative basis, and the saving possible is probably much greater. For reasons already stated, if ordinary motors were employed, they would be working well down their characteristic curves owing to the high torque required on starting, and consequently their performances would be much worse than those taken for the above estimate. It may here be pointed out that textile motors must be designed so that their characteristic curves are as flat as possible, as the load varies somewhat between empty bobbin and full bobbin.

Finally the question of speed requires consideration. Many motor manufacturers do not realise the importance of the fact that duplicate machines should have the same full-load speed. It is practically impossible for this to be achieved within 0.75 per cent., but in many cases the variation is much greater than this. If textile machines for the same process vary considerably in speed, labour troubles have a tendency to occur, due to one machine running faster than its neighbour, particularly if "piece work" is being done.

The next item of expenditure to consider is the driving gear between the motor and the machine. It has previously been shown how the centrifugal coupling may be replaced by a cheaper flexible type. In the case of ring frames, where only one spindle speed is required, the motor can in most instances be coupled direct to the tin roller shaft by means of a flexible coupling. If, however, various spindle speeds are required due to the spinning of different classes of yarn on the same frame, direct coupling is not permissible, and some other means of driving is required. One of the cheapest methods is to mount the motor on the top of the frame end with or without a spring cradle, and drive on to the tin roller shaft by means of a leather belt and pulleys. In this way, by changing the pulleys, different speeds can be obtained. This method, while fulfilling all reasonable requirements, is not æsthetic, and cannot be compared with chain driving from an appearance point of view. The disadvantages of chain driving, however, are high first cost, high upkeep charges, and the necessity of a gear case with oil bath which is difficult to make absolutely oil tight. For this class of drive there is room for experimental work on the part of makers of leather belts, such as are used for driving the air circulating fans on motor cars. A satisfactory flexible leather belt which would transmit 5 h.p. without undue slip, and with pulley centres between 1 ft. 6 in. and 2 ft. apart, would provide a cheap method of driving machines under the above conditions. Such belts would require to have a reasonably long life, and to contain no metal fastenings which would fly off as the belt became worn, and thus be a danger to workers in the vicinity. Another type of belt that might be used is of the kind used to transmit the power from the engine to the rear wheel of a motor cycle. So far, however, neither of these types can be said to be absolutely satisfactory, chiefly owing to their short life and to the danger of parts flying off. But it should not be beyond the power of manufacturers to produce a satisfactory belt on the lines suggested. In some cases, gearing may be used to transmit power from the motor to the machine, but unless the speed reduction required is great, gears are too expensive to be used as a standard drive.

The last item of equipment deserving consideration is the switchgear. In many installations this part is far too elaborate and costly. For all motors up to 10 h.p. in reasonably large installations a straight "throw-on" switch without any trip coils or fuses meets with requirements. This does not mean that each motor should not be protected by fuses, but that the fuses should all be grouped together on distribution boards and the circuits run straight from these boards to the motor switches. The danger of taking excessive currents from the line on starting can be obviated by starting up the motors in each room one after the other. If this is done, the power supply company will usually waive their requirements as to the use of star-delta starters. The switchgear should be of the quick-make and break, air-break, ironclad type, and reasonably easy to operate. It should not be forgotten that in most cases young girls perform the duty of starting and stopping the motors, and some switches are far too heavy for such people to operate with ease. The operating handle should be mounted on the outside of the case, and not brought through the cover, so that no flash can be seen when breaking the circuit, as girls are apt to become somewhat frightened if they are able to see a flash on operating a switch. For very small motors, some money may be saved in wiring by having a fusebox for each motor located on the floor, and looping, say, four such motors on to one circuit of the main distribution board. The advantage of having the motor fuses in a separate box from the switch is that the fusebox can be fixed underneath the frame out of the way, and the switch case is kept smaller in size.

In conclusion, the whole electrical equipment should be small in size, and whenever possible incorporated inside the machine. In this way motor bedplates can often be dispensed with, as the motor can be mounted on some part of the frame. This method also economises floor space, and allows a larger number of machines to be installed on a given area, thus reducing overhead charges. When deciding on the position of a motor, due regard must be paid to accessibility, as it is false economy to have practically to dismantle a frame to release the motor in the case of a breakdown.

From the above remarks it will be seen that individually-driven machinery can be made to operate at high efficiencies, with a reasonably low initial expenditure, and if due regard is paid to the driving equipment, the additional cost entailed over group driving is more than compensated by the advantages that such a system offers.

The Future of Electricity Supply in France.—Among a series of articles now being published in a French industrial newspaper concerning the possible situation of French industries in a period of 25 years from the present time is one by M. Jean Tribot-Laspière, general secretary of the Union des Syndicats de l'Electricité, who expresses the view that by 1950 the thousands of small generating stations will have long disappeared and the wastage of coal and heavy oils will have ceased. These small stations will be replaced by large stations, some of which will have a capacity of 500,000 kW each. At present there are 110 central stations of 10,000 kW and over; this capacity will be considered very small in 25 years and the total number of works will perhaps not exceed 100. The large stations will no longer be isolated, but be interconnected by means of high-pressure lines which will ensure the regularity and security of generation. These h.p. lines will constitute a national network and will probably be operated at 220,000 V, permitting the producing companies to transmit and interchange considerable quantities of energy. It is also considered that the electrification of the rural districts will have been solved by 1950 and that 40,000 French communes will then have a supply of energy as compared with the 10,000 at the present time. Electric power will have replaced domestic servants or reduced their labours, and factories and workshops will all be electrically equipped. M. Tribot-Laspière foresees that all the railways will have followed the example of the Orleans, the Southern and the Paris, Lyons and Mediterranean railways, and have substituted electric for steam traction. Moreover, a great future is held out for electrical vehicles when garages and charging stations exist all over the country and accumulators will have been standardised and spare sets rendered available for placing on vehicles in a few minutes.

Electric Trucks for Peru.—It is reported that the Central Railway Co., of Peru, has recently ordered from England a number of electric platform trucks for use at the Desamparados station in Lima. This is the first instance of such trucks being used in Peru.

The Revolving Short-Wave Beam System.

The South Foreland Experimental Direction-giving Installation.

THE probability of a great advance upon the present lighthouse system of guidance for ships at sea may be inferred from the success which the latest developments of Marconi's Wireless Telegraph Co., Ltd., have met in the experimental stages. These developments, the revolving short-wave beam wireless system, and the experimental installation which has recently been erected on the cliff at South Foreland, were successfully demonstrated on Friday last to a party of Government, shipping and Press representatives in which we participated. An eight-hours' cruise was undertaken on Senatore Marconi's yacht the *Elettra* from Dover, round the East Goodwins, to Southend. Signals were sent out by the transmitting station and picked up aboard the *Elettra* continuously throughout the cruise. Senatore G. Marconi himself welcomed the visitors, and his assistant, Mr. C. S. Franklin, conducted the demonstration.

The Marconi revolving beam is a special application of the principles of directional wireless transmission to the purposes of navigation. Signals are projected in a narrow beam of, say, 15 deg., and a different Morse signal is transmitted as the beam points successively to different selected points of the compass. The observing officer on the ship listens through the medium of a simple form of receiver and hears a series of perhaps five or more Morse letters as the beam sweeps slowly past the ship. The Morse letters which he hears tell him, by reference to a chart similar to the one illustrated in fig. 4, the direction in which the beam is pointing at that instant, and therefore the bearing corresponding to the middle letter of the series of letters heard gives him his exact bearing in relation to the transmitter. The navigator is able to take any number of bearings at short intervals, and by co-ordinating these observations with the speed and course of the vessel he may determine his exact position by ordinary methods of triangulation.

The principal features of the rotating-beam system of direction-giving are as follows:—

It is quite independent of the weather conditions. The signals are transmitted on a very short wavelength; they do not, therefore, interfere with the working of any of the commercial wireless stations in the vicinity, nor are they jammed by such stations. The signals are received by the observer on an instrument which can be set in operation by merely closing a switch, and which requires no adjustment other than turning a handle to reduce its sensitiveness should the vessel be too close to the beam transmitter. No technical knowledge or skill is required in its use. The receiver can be installed in any convenient position in the chart house, enabling the navigator to make his own observations whenever he requires them. Each signal consists of a single Morse letter sent at a speed of about 10 words per minute, therefore only a very elementary knowledge of the Morse code is necessary to interpret an observation. The freedom of the signals from any kind of interference is a great advantage in this respect. The receiving apparatus is entirely independent of any other wireless installation with which the vessel may be equipped. All the expensive and complicated part of the system is centralised in the transmitting station on land. The simplicity and consequent low cost of the receiving apparatus brings the system within reach of all classes of vessels, large and small. Even small tugs and fishing trawlers can therefore take advantage of the great assistance to navigation offered by the system.

These characteristics make the rotating-beam system of direction-giving particularly suitable for use in congested waters near points of danger to shipping and near the approaches to harbours. Its range of action is approximately the same as that of a lighthouse, but, being unaffected by conditions of visibility, it becomes an invaluable auxiliary in time of fog and storm.

The transmitting apparatus located at the South Foreland Lighthouse comprises a valve transmitter which with the necessary generating machines and auxiliaries is housed in a small hut, and a unidirectional aerial system mounted on a revolving steel framework. The energy for the transmitter and for revolving the aerial is supplied from the Dover electricity undertaking. The valve transmitter operates on a 6-metre wave, the high-pressure supply to the anode of the valve being about 280 W, and a high-frequency supply is conducted from the transmitter to the revolving aerial through insulated wires in an earthed metal conduit. The unidirectional aerial system, shown in fig. 1, comprises a number of energised aerials in a straight-line formation, together with a number of reflecting aerials arranged in a line parallel to the line of the energised aerials, the plane containing the reflecting aerials being approximately one quarter-wavelength distant from the plane containing the energised aerials. All the aerials are vertical, and are approximately one wavelength in height. Special arrangements are provided for ensuring that the currents induced in all the energised aerials are in phase with one another, and also that the phases in the top and bottom sections of these energised aerials are the same. The width of the aerial system is nearly four wavelengths, so that the plane area of this aerial system is nearly four square wavelengths.

The measured polar curve of radiation from the aerial system in the horizontal plane is shown in fig. 2, and measurements show that the energy sent out in the line of maximum radiation in the horizontal plane is between thirty and forty times that which can be obtained from a simple broadcasting aerial receiving the same amount of energy. The aerial structure is arranged to rotate continuously, and to send distinctive signals which

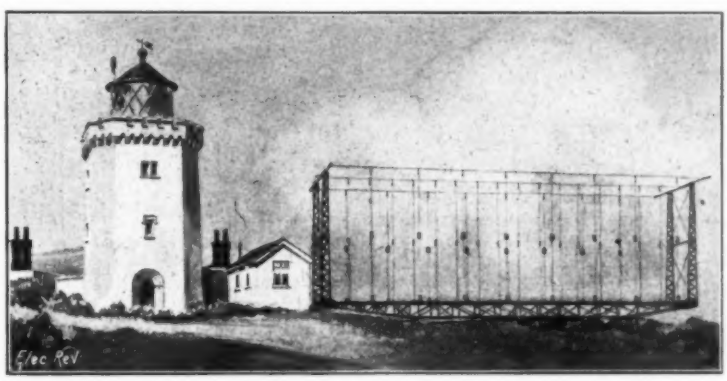


Fig. 1.—Transmitting Aerial at South Foreland Lighthouse.

Fig. 2.—Polar Curve of Radiation.

indicate the direction at which the aerial is pointed at that moment. On the chart a number of lines are set out radiating from the South Foreland, and when the aerial is pointing midway between any two of these lines, the sign marked on the chart is being sent.

The direction of maximum radiation is at right angles to the plane of the energised aerials, and in the direction away from the reflecting aerials. The transmission of the distinctive signs is arranged automatically by means of plates representing the Morse characters, mounted on a large ring carried by the revolving structure (fig. 3), which actuate a contact mechanism as the structure revolves, and so control the operation of the transmitter, thus ensuring that the signal transmitted depends upon the direction in which the aerial is pointing. The

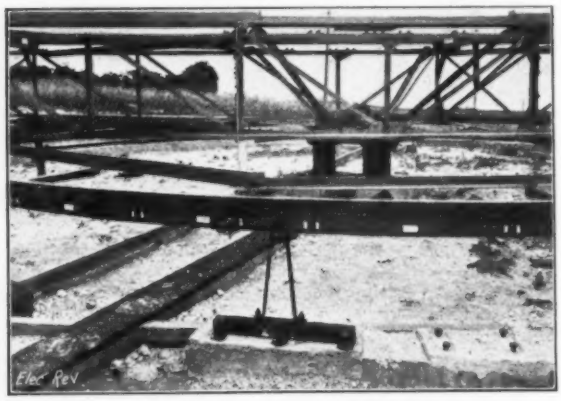


Fig. 3.—Base of Revolving Frame, showing contact mechanism.

wooden superstructure at present supporting the aerials, shown in fig. 1, is experimental, and in future practice the aerials would be supported from steel towers mounted at each end of the structure.

On the *Elettra* two receiving aerials are employed, mounted one at each end of the bridge. Connection is made to each aerial by means of a lead-covered cable, which is led into the chart house, and either can be connected to the receiver located there. This arrangement ensures against the aerial being screened too much by the ship itself for the longer ranges. The operation of determining the direction of the ship relative to the South Foreland is simple. At intervals of about two minutes three or four strong signals are heard in the receiver. By noting what these signals are, a glance at the chart, fig. 4, will at once show in which sector the ship lies. For instance, if the letters I X I T are heard, then the ship will be approximately on the line between X and I sectors (that is to say, exactly between the extreme I and T sectors.) Should the receiver be too sensitive, so that more than three or four signals are heard, the controls are adjusted to reduce the sensitiveness, and eliminate the weaker signals, leaving the stronger signals of the beam audible. The weak signals are produced by the small loops shown on the polar diagram of radiation, and are what are known in optics as "diffraction fringes." The main beam signals are always very prominent, but if the range is short the signals produced by these diffraction loops may be strong enough to blur the bearing, unless the receiver is adjusted so that they are

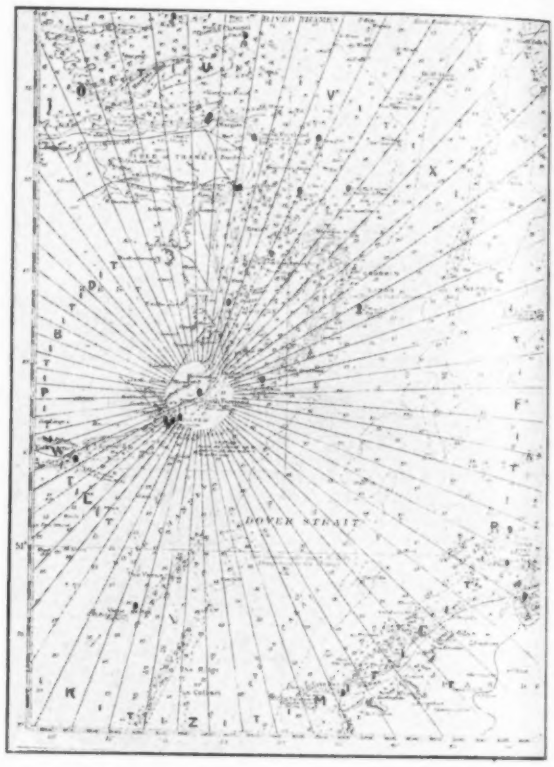


Fig. 4.—Chart of Area Covered from South Foreland.

eliminated, or made very weak. The receiver now being used on the *Elettra* is not in its commercial form. This will comprise two cases: one, the receiver proper, which will be provided with a single control handle, whilst the other will contain the necessary batteries, which can be located in any convenient position.

The South Foreland installation has been tested, and has given signals to the *Elettra* up to 100 miles over sea. During the latter part of the voyage of the *Elettra* from Dover to Southend, the transmission from South Foreland to the *Elettra* took place, of course, mostly over land, affording an opportunity of noting that the effects of land, as regards both strength of signals and directional errors with these very short waves, were unimportant.

The Carbonisation of Pulverised Fuel.

The McEwen-Runge Low-Temperature Process.

We recently drew attention to the advantages to be derived from the carbonisation of pulverised fuel by a process which at the same time strips the coal of its valuable volatile constituents and yields a solid fuel in the form of pulverised semi-coke, which is well adapted for immediate combustion in boiler furnaces. We have now received particulars of the process in question, from the inventor, Mr. S. McEwen, A.R.S.M., A.I.M.M., of which an abstract follows.

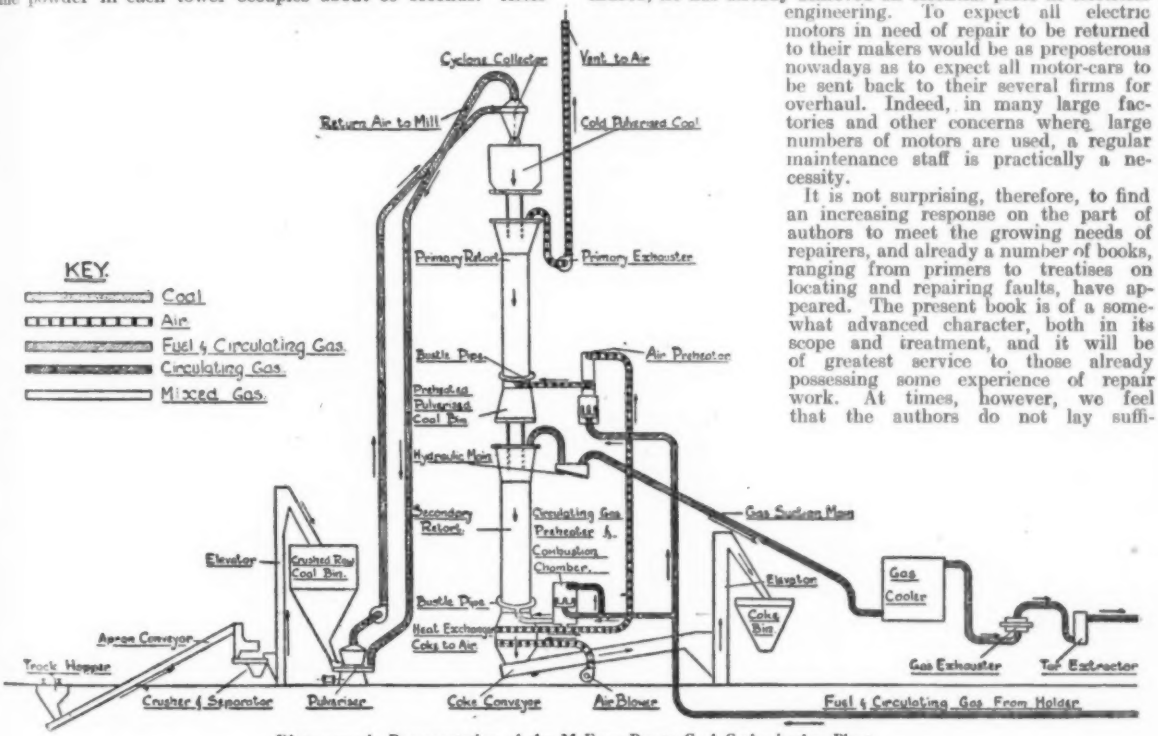
We may premise that many attempts have been, and are being, made to develop a satisfactory process for carbonising coal at low temperature and that the Fuel Research Board has not only carried on experimental investigations in its laboratories at Greenwich but has also offered facilities for testing processes devised by inventors unconnected with the Department. Hitherto, whilst one or two concerns have succeeded in placing semi-coke on the market, low-temperature carbonisation has been more or less under a cloud, except in political propaganda, where it has been utilised—on paper—with remarkable optimism. Two adverse factors have been mainly responsible for the delay in attaining commercial success—namely, the long time required to carbonise coal at low temperature, necessitating the use of retorts of small capacity; and the friability of the resulting semi-coke, which rendered it unsuitable for transportation. The new process overcomes the first difficulty by dispensing with retorts, and the other objection is removed by the increasing use of powdered coal in boiler furnaces. In fact, it is entirely due to the latter development that the carbonisation of pulverised fuel at low temperature has become commercially practicable. Obviously powdered fuel is useless for domestic purposes, and therefore the McEwen process can only be considered in connection with industrial applications.

Briefly, the McEwen-Runge process consists in the pulverisation of the coal and its elevation to the top of a tower, down which it falls in the form of a cloud, passing through a counter-current of hot inert gases. The enormous extent of surface presented to the hot gases by the powdered fuel ensures a rapid interchange of heat, so that carbonisation is effected by the time the fuel reaches the bottom of the tower. The process is extremely simple, and is continuous, the finely

divided semi-coke being withdrawn from the foot of the tower and delivered to the furnaces, whilst the gases carrying the volatile constituents of the coal pass away at the top to treatment plant of the usual description.

It is stated that the process may be operated in a variety of ways, to produce either a very rich gas or a low-grade gas, according to local requirements. It may be either a single-stage or a two-stage process; the latter has the higher thermal efficiency, and is better suited to a wide range of fuels. In the first stage moisture, CO_2, and gases of no heating value are eliminated, and in the second stage a higher temperature is employed, carbonising the fuel. The heat required for the first stage is extracted from the carbonised fuel semi-coke by a heat exchanger, thus recuperating the sensible heat of the semi-coke and securing a very high thermal efficiency.

The two stages are carried out in steel towers lined with refractory material, one above the other, about 30 feet in height and 6 feet in diameter. For the preheating stage air is used, heated by the semi-coke (without contact with it), and passing off into the atmosphere at a temperature of 500 deg. F. In the second stage the temperature of the gas at admission is about 1,500 deg. F., and it leaves the top of the tower at about 600 deg. F.; this gas can be heated by the combustion of about one-third of the gas that is manufactured. The treatment of the powder in each tower occupies about 35 seconds. After



Diagrammatic Representation of the McEwen-Runge Coal Carbonisation Plant.

treatment in the first stage the powder passes into a hopper, whence it is conveyed to the second tower; the whole process occupies about 6 minutes, and the through-put per day is stated to be 210 tons per unit of plant. The accompanying illustration shows diagrammatically the arrangement of the plant, omitting the gas-holder. The carbonising current of heated gases may consist of preheated permanent gas, or products of combustion either introduced into the tower or generated within it by the admission of a suitable quantity of hot air.

It is claimed that the powdered semi-coke is superior to pulverised coal for burning in furnaces, being less dense and presenting a greatly increased surface per unit of weight, so that combustion is very rapid. It can be transported to the consumer in tank cars, and may be treated as a fluid, being pumped through pipes, &c., like oil fuel. As it is dry, the cost of carriage per ton of combustible is less than that of coal, which always contains moisture, and the calorific value of the semi-coke is higher per pound than that of coal. A much greater quantity of tar is produced per ton of coal carbonised at low temperature than in the case of high temperature carbonisation, and from it can be obtained a variety of light and heavy oils and other products. The gas obtained is also of greater heating value than that produced at high temperatures—approximately 750 B.th.u. per cubic foot—and contains benzene. The particles of semi-coke neither agglomerate nor adhere to the sides of the towers; the powder does not cake when stored, nor is it liable to spontaneous combustion.

The process is being developed by International Combustion, Ltd.

Electric Launches for Italian Postal Service.—The Italian postal authorities are now using a number of electric launches fitted with Tudor batteries in connection with the postal service in Venice.

Reviews.

Connecting and Testing Direct-current Machines. By F. A. ANNETT, M.A.I.E.E., and A. C. ROE. Pp. x+237; figs. 172. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

In informing the reader that most of the material in this book has already appeared in *Power*, the interesting revelation is made that the articles on "Locating Faults in Direct-current Armatures" appeared under the name of B.A. Briggs, who in real life is F. A. Annett, assistant editor of *Power*. The experience of the second author, Mr. Roe, would seem to qualify him as an author on repairing and testing electric machines.

The contents of the book are fairly well described in the preface, namely, reconnecting direct-current machines for a change in voltage, speed, or both; and locating and remedying faults in direct-current machines. Considering the great and increasing number of electrical machines in all countries, there is no need to emphasise the importance of the repairer—indeed, he has already achieved an essential place in electrical engineering. To expect all electric motors in need of repair to be returned to their makers would be as preposterous nowadays as to expect all motor-cars to be sent back to their several firms for overhaul. Indeed, in many large factories and other concerns where large numbers of motors are used, a regular maintenance staff is practically a necessity.

It is not surprising, therefore, to find an increasing response on the part of authors to meet the growing needs of repairers, and already a number of books, ranging from primers to treatises on locating and repairing faults, have appeared. The present book is of a somewhat advanced character, both in its scope and treatment, and it will be of greatest service to those already possessing some experience of repair work. At times, however, we feel that the authors do not lay sufficient stress on the difference between temporary makeshifts and sound repair. For example, when changing from lap to wave winding, the reader is told that "the extra bar may be eliminated by connecting two together and using them as a single bar." This is not good practice. Also it should be emphasised that cutting out armature coils is a temporary expedient. There are other points which do not rouse our admiration. "Changing coil pitch" is introduced thus: "In many cases when an armature is being rewound the coils are made up, and when they are being put into the slots it is discovered that in some manner they have been made shorter than those in the old winding. . . ." This strange indictment of repairers is followed by a technical discussion on fractional-pitch windings. Further, we do not see what good is served by illustrating and describing a winding having alternate two- and three-turn coils. More space might be devoted to methods of overcoming difficulties in accommodating other sizes of wire—for example, the use of small wires in parallel might be mentioned.

Also in the second part of the book some of the methods described savour of the makeshift. The various methods of locating faults in armatures and in field windings are dealt with in detail, and the information in these chapters is some of the best in the book.

Elements of Electrical Engineering. By ARTHUR L. COOK. Pp. viii+568; figs. 365. London: Chapman & Hall, Ltd. Price 20s. net.

This is an American text-book comprising four main divisions, covering respectively: direct current and magnetic circuits, direct current machinery, alternating currents, and alternating current machinery. In the first part we notice that the subject of direct current and resistance measurements which usually finds a prominent place in elementary d.c. theory, is

hardly touched upon, whilst the short chapter on electrostatics and condensers is somewhat meagre. The second part is more satisfactory, the treatment of direct current generators and motors being very clear and thorough. Short chapters on primary and secondary batteries, and d.c. transmission and distribution, are included in this section. In the third part the author has endeavoured to develop the elementary theory of a.c. circuits for the non-mathematical student, and considerable care has been devoted to a very complete consideration of polyphase circuits. The fourth part deals in considerable detail with transformers, alternators, a.c. motors of the induction and synchronous types, and rotary converters. The treatment is elementary, but thorough. The chapters on single-phase motors, a.c. rectifiers, and switchgear and protective devices are more superficial. The concluding chapter deals briefly with lighting and illumination. The chapter on the application of a.c. and d.c. motors is a very good one, and recapitulates the characteristics of these machines with reference to varied industrial requirements in a very practical fashion. In neither of the two parts dealing with a.c. working are there any but passing references to alternating current instruments or measurements. We note a slip on p. 423, where the constant 2.22 in the formula for the voltage of an alternator is said to be the form factor of a sine wave.

The impression received from a perusal of this book is that the author has been somewhat too eager to follow the prevailing American fashion of avoiding mathematics in elementary text books, and that the solidity of the foundational work has been considerably impaired. Fundamental theorems and formulas are given without, in many cases, any attempt to give an elementary proof. Whilst it is quite possible for students to acquire a sound knowledge of elementary a.c. theory without a knowledge of the methods of the calculus, we question whether any real progress will be made with the paucity of mathematical knowledge assumed by the author of this book. In the third section it would appear, therefore, that a detailed consideration of the properties of the sine function would have been of more real use to the average student than some of the rather superficial descriptive matter which is found in other parts of the book.

A large number of examples are given at the end of each chapter, the answers to which are not found in the book. The diagrams and the get-up of the book are both excellent.

Practical Handbook on Electroplating. Pp. xiv+269; illustrated. Ninth Edition. Birmingham: W. Canning & Co., Ltd. Price 4s. 6d. post free.

As stated in the introduction, the aim of this handbook is to "present in the simplest and most direct language the actual detailed operations, in such a way that the employer or foreman may gauge the materials to be employed, and the operator may intelligently grasp the essential details of the work." It is a compliment to Messrs. Canning that their book should run into nine editions, the first having appeared in 1889. The present edition has been entirely rewritten.

The book is divided into four sections, dealing respectively with grinding and polishing; cleansing and dipping; electroplating; and bronzing, lacquering and enamelling. Considerable attention is given to nickel plating, as it is of great commercial importance as well as a typical plating operation. The electrodeposition of other metals is also dealt with, *viz.*, cobalt, copper, brass, silver, gold, tin, zinc, lead, cadmium, chromium, and platinum. Several tables are given at the end of the volume, tabulating the current densities of the metals, voltage required for still plating, and the copper deposited from solutions at given current densities, together with comparisons of thermometric and hydrometric scales.

The volume contains a fair amount of propaganda work for the products of Messrs. Canning, which are kept well to the fore throughout the publication.

Practical D.C. Armature Winding. By L. WOLLISON. Pp. xii+228; figs. 152. London: Sir Isaac Pitman and Sons, Ltd. Price 7s. 6d. net.

This book is written from the practical winder's point of view, and is intended to provide in a small space all the information that is really necessary to the practical man. Some of the information comes within the scope of the designer and the draughtsman, and is usually given to the winder in the form of instructions, but we agree that the more thoroughly the winder understands his work, the better job he will make of it.

The author is the foreman of the winding departments of Messrs. Bruce Peebles, and also a lecturer in armature winding at the Leith Technical College. His practical experience is obvious throughout the book. The following extracts will make this clear. "In every instance, experience, commonsense, and continuous care are essential to the production of reliable winding. . . . Probably in armature winding, more than in any other trade, good workmanship at all stages is of the greatest importance. . . . The life and successful working of an electrical machine, and, incidentally, the reputation of its producer, may therefore depend in large measure on the careful workmanship of the armature winder. . . . 'Prevention is better than cure.'"

The first part of the book deals with the theoretical aspect, explaining how to arrive at the winding-spans, &c. The author's lecturing experience has enabled him to make his explanations very clear, but we wish to criticise some of the terms and symbols. For example, a single coil is called a "unit," which appears to be a very good name. A number of units grouped together to occupy a slot is, however, called a "coil." This name does not seem a happy choice, because it is not a coil, but a group of coils. Again, the number of slots spanned by a coil is called the "core-pitch." This term does not convey its meaning at first sight, and we suggest that "slot-span" might be better. Generally speaking, the word "pitch" could be replaced with advantage by "span," but in this the author only follows the usual practice of other writers. With regard to the symbols, R is used both for the number of equalising rings and for the degree of re-entrancy, while M denotes the number of pairs of paths, instead of the recognised *a*. Apart from these criticisms of minor details, the explanations are very clear, especially those of multiplex windings.

The second part deals with modern practice. It is, of course, impossible to deal with all the various methods which are in common use, but the author describes typical methods and points out concisely what is required to make a good job. Testing is gone into very thoroughly, it being recognised how important it is that a winding should not break down after it has been put into service. All the various faults which can occur are pointed out and the methods by which they can be detected are explained.

The diagrams are very clear, but it would have been an advantage to add a title to each one. The book will certainly be of use to the student as well as to the practical winder.

The Story of Electricity. By W. F. F. SHEARCROFT, B.Sc., Hons., Lond., A.I.C. Pp. 73; figs. 3. London: Ernest Benn, Ltd. Price 2s. 6d. net.

Although the title of this little book is probably not altogether suggestive of the contents, the work is certainly a story, fascinating, and well written in non-technical language which renders it readable by any intelligent person. It contains a survey of the theories of electricity which have been advanced from the time of Thales' observation of the peculiar property of amber up to the present day when our modern scientists are occupied with applications of the quantum theory, &c. The concluding chapters, in dealing with the construction of the electrons and protons, draw a picture which will give a clear idea of the fundamentals of matter and its close relationship to electricity to the person of non-technical mind. Its reading will not be a waste of time to any who pick up this little volume.

Relativity: A Very Elementary Exposition. By Sir OLIVER LODGE, F.R.S. Pp. 41. London: Methuen & Co., Ltd. Price 1s. net.

This is a lecture delivered to the Literary and Philosophical Society of Liverpool in 1921, and it is well worth reading by those who have neglected to acquire a nodding acquaintance with the subject. There are three reasons why it is worth their while. First, because Prof. Lodge has a happy gift for exposition which makes the book a pleasure to read: secondly, because it is short and, as the sub-title most truthfully declares, easy to understand; thirdly, because it is well that those who have neglected to acquire even a slight acquaintance with the subject should avail themselves of a good opportunity for doing so. This last reason will be made the more manifest by a perusal of the book, for therein it will be seen with what reluctance the world of science allowed itself to be convinced of the importance of this subject.

At first sight the theory of relativity appears to any practical man mystical and visionary. His natural inclination is to dismiss it from his mind as void of all practical significance. This attitude was shared by almost all the lights of science up to the beginning of this century. It was only by sheer force of cumulative evidence that a change in that attitude was brought about. In the little book before us it can be seen how the weight of that evidence grew and began to tell, until now the whole field of physical science is embraced in it, and the veil of metaphysics seems to settle over all.

Thus the book closes with a quotation from Eddington: "We have found a strange footprint on the shores of the unknown. We have devised profound theories to account for its origin. At length we have constructed the creature that made the footprint, and lo! the footprint is our own."

Fifty years ago one who picked up a little book which ended with a paragraph like that would suppose he had got hold of a religious tract of some kind.

New American Plant in Service.—According to *Power*, the Bureau of Power and Light of Los Angeles placed the first 4,000-h.p. unit of its Big Pine power plant in operation on July 31st. Work on the installation was speeded up in order to be able to furnish an emergency service to a number of mines and industrial plants in the Owens Valley region, which were temporarily without power because of damage done to the feeder lines of the Southern Sierras Power Co. during a violent electric storm and cloudburst. Power from the Big Pine plant is to be used in pumping water from approximately 300 wells in Owens Valley into the aqueduct for the water department of the city of Los Angeles.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Cycle and Motor Cycle Show.—This show, which is to be held at Olympia, will be opened by Mr. L. C. M. S. Amery, P.C., M.P., Secretary of State for Dominion Affairs and the Colonies, on September 21st.

The Coal Inquiry.—The Royal Commission appointed to inquire into the coal industry is composed as follows:—Sir Herbert L. Samuel, G.B.E. (chairman), Sir William H. Beveridge, K.C.B., General Sir H. A. Lawrence, K.C.B., and Mr. Kenneth Lee. The following expert advisers have been appointed to assist the Commission:—The Rt. Hon. William Brace, Chief Labour Adviser to the Mines Department; Dr. Walcot Gibson, F.R.S., formerly an assistant to the Director of the Geological Survey of Great Britain; Major H. M. Hudspeth, D.S.O., Divisional Inspector of Mines; and Dr. C. H. Lander, Director of the Fuel Research Department of the Department of Scientific and Industrial Research. Mr. C. S. Hurst, O.B.E., of the Mines Department, will act as secretary. The terms of reference to the Commission are: "To inquire into and report upon the economic position of the coal industry and the conditions affecting it, and to make any recommendations for the improvement thereof."

A London Company's Hiring Scheme.—The WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD., has sent us a copy of a booklet which it is issuing to its consumers. This contains illustrations and particulars of charges and running costs of the appliances which can be hired from the company. Included in the list are cookers, fires, boiling rings, irons, &c. The cooking and heating rate is reasonable, as are the hiring charges, although we think that the payment of the latter in advance may act as a deterrent to many potential users.

Lighting Propaganda.—Preparations are now being made for the coming winter—another lighting season—and the lamp manufacturers have produced attractive schemes for the education and enlightenment of the public. The BRITISH THOMSON-HOUSTON CO., LTD., has sent us a selection of the pamphlets, &c., which it is issuing to contractors and others. A special window display employing and advertising "Mazda" lamps is offered and the price lists and other publications have been produced in an attractive style.

We have also received similar matter from the GENERAL ELECTRIC CO., LTD., but in this case the whole of the details of the company's campaign to popularise "Osram" lamps are contained in a large brochure which is copiously illustrated. Advice is given on window dressing and interior displays, the training of salesmen, postal and newspaper advertising, &c. The "Osram Baby" appears in a new design.

Another leading company which has also produced a special scheme is the SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD. The matter sent us includes a number of illustrated pamphlets and other publications, and the "Siemens Wizard Electric" game. A special feature is a design which is being used on posters and showcards—a nude figure silhouetted against the light from a "Siemens" lamp. The company's scheme also includes extensive newspaper and hoarding advertising.

Electric Lamp Trade Competition in South Africa.—In commenting upon the increased competition from foreign electric lamps in South Africa, the *British and South African Export Gazette* states that the Johannesburg Corporation Finance Committee, after examining certain tenders, reported that the lowest-priced lamps offered were of Continental manufacture, but that the Corporation had had practically no experience of that particular make. It was added that lamps which were of perfectly good appearance did not always prove suitable for street-lighting purposes, but might burn out in a short time, and though low in price, prove exceedingly expensive in use. Our contemporary urges British manufacturers to make greater efforts to keep the merits of British lamps constantly before municipal buyers, and adds:—"Additional propaganda work here, and also among the importing houses and their shipping connections in the United Kingdom, will go a long way towards restoring the British share of the trade to its former greatness, and will also ensure participation by the United Kingdom in the certain future expansion of the business."

New Municipal Showrooms.—The Salford Corporation proposes to purchase the premises of Messrs. W. H. Sutton and Sons, in Chapel Street and Bexley Square, for the purpose of showrooms for electrical appliances.

Lead.—Reporting on September 5th, Messrs. James Forster & Co. stated:—"Consumption is still very big, particularly in the electrical trades, but it must be remembered that the extensive buying by cable makers recently will probably mean that they will be out of the market for some weeks, and in order to prevent prices sagging further, other buying must take its place. Meanwhile, there is an acute shortage of early lead, particularly of good brands, owing to the shipping strike in Australia. This should be only temporary, however, as the lead which is being delayed will come forward in larger quantities later on. The outlook is rather obscure, and we think calls for a certain amount of caution on the part of consumers."

Hackney Publicity.—In preparation for the opening of its new showrooms and offices, which were described in our issue of June 13th, 1924 (p. 952), the Hackney Electricity Department is issuing a poster produced in conjunction with the British Electrical Development Association. This depicts a very imposing edifice of rather severe outlines bearing the Hackney coat of arms above the entrance. The building promises to be a veritable "Temple of electricity."

D.O.T. Advisory Committee Appointments.—The Parliamentary Secretary to the Department of Overseas Trade has recently appointed a number of additional members to his Advisory Committee, among whom are Col. F. V. Willey, C.M.G., president of the F.B.I., Sir Arthur Balfour, K.B.E., Sir William Larke, K.B.E., Sir Charles Mandleberg, Mr. J. T. Brownlie, Mr. P. J. Pybus, C.B.E., and Sir Max Muspratt, Bart.

Correction.—In the advertisement of HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD., appearing in our last issue (Supplement p. 2) an error occurred in the preparation of the copy. The third paragraph on the right-hand side referring to "Over Potential Test" should read as follows: "The overpotential test consists of the application—across the winding of twice the rated pressure for a period of 15 minutes. (The B.E.S.A. specification calls for a period of one minute only.)"

Annual Sports.—The annual sports of the staff and employés of the Metropolitan-Vickers Electrical Co., Ltd., were held at the Belle Vue Grounds, Manchester, recently. There was a large and enthusiastic attendance. The accompanying picture shows Mrs. J. C. Whitmoyer presenting prizes to the successful competitors. Supporting her (from left to right)

Metro-Vic. Sports at Manchester.

are Mr. Baxendale, hon. secretary of the Sports Committee, Mr. Fraser, superintendent of the Large Machine Department, Mr. Walmsley, superintendent of labour, Mrs. G. E. Bailey, Mr. G. E. Bailey, and Mr. A. E. du Pasquier, manager of the Publicity Department.

A Works Dental Clinic.—As an addition to the arrangements made by the CHLORIDE ELECTRICAL STORAGE CO., LTD., for the welfare of its employés, a dental clinic was recently opened at the Clifton Junction works. The clinic consists of a dental surgery, a rest room, and a waiting room, and is in charge of a fully-qualified dental surgeon assisted by an experienced nurse.

For Sale.—Carlisle Corporation electricity department has for disposal surplus transformers, h.p. fuses, isolating switches, &c. (See our advertisement pages to-day.)

Trade Announcements.—MESSRS. RADIO INSTRUMENTS, LTD., are appointing Mr. H. Patrick, 246a, Corporation Street, Birmingham, as their representative for Birmingham and the Midland Counties, and he will hold stocks at the above address. He will continue to act as agent for Messrs. H. Hunt.

MESSRS. ALLEN-LIVERSIDGE, LTD., have taken over the sole selling agency for Great Britain and Ireland of the electric welding products of Messrs. Buckley, Saunders & Co., Ltd., including "Pontelec" welders and rivet heaters.

New premises have been opened by Messrs. HILL, UPTON AND CO., electrical engineers, at "Radiant House," George Street, Oxford.

MR. H. FEATHERSTONE, electrical and radio engineer, of Tunbridge Wells, has opened a branch business in High Street, Wadhurst, Sussex.

THE AMPLION CORPORATION OF CANADA, LTD., 130, Richmond Street West, Toronto, Ontario, has been formed to import, assemble, and/or manufacture, and sell the products of Messrs. Alfred Graham & Co. in Canada. Hitherto Amplion business was administered, as general agents, by Messrs. Burndept of Canada, Ltd., who will continue, for the time being, to act as wholesale distributors for the Amplion Corporation. Messrs. Graham have also just opened a new Amplion showroom and depôt at 101, St. Vincent Street, Glasgow.

THE STEARN ELECTRIC CO., LTD., has opened a branch at 15, Park Row, Nottingham, under the management of Mr. M. Thorburn.

Catalogues and Lists.—MESSRS. L. ANDREW & Co., 2, Whitworth Street West, Deansgate, Manchester.—Wholesale price list of india-rubber gloves and gauntlets.

MESSRS. HANS RENOLD, LTD., Burnage Works, Didsbury.—An illustrated catalogue of driving chains of various patterns. Priced.

SUPERLAMP, LTD., 92-94, Paul Street, Great Eastern Street, E.C.2.—Two net trade price lists dealing respectively with electrical material and radio apparatus.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38 and 39, Upper Thames Street, E.C.4.—September price list of electrical appliances and materials. Also an illustrated folder giving prices of "Siemens" electric lamps, and List No. 8, giving illustrated and priced details of "Siemens" spotlight projectors.

THE CRESSALL MANUFACTURING CO., 40-41, Staniforth Street, Birmingham.—Leaflet No. 20, illustrating and describing "Cressall" steel-jacket unit heaters.

MESSRS. E. BROOK, LTD., Empress Works, Huddersfield.—Booklet No. 123, dealing with the firm's single-phase, high-torque squirrel-cage motors.

THE WHITWORTH ELECTRIC LAMP CO., LTD., 195, North End Road, West Kensington, W.14.—September price list of electrical materials and appliances.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet Ta 154/1, illustrating and describing some large transformers built by the company.

"MANDA" MOTORS, LTD., 53-54, Royal Mint Street, E.1.—A trade list of electric fans, fractional-h.p. motors, &c.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Book 5, Section 1, illustrating and describing the "Pul-syn-etic" system of electric impulse clocks and time-keeping apparatus. Priced.

MESSRS. STURGE & BAKER, LTD., Premier Works, Sheepcote Street, Birmingham.—An illustrated and priced leaflet dealing with flex-winders for portable electric lamps.

HIGGS MOTORS, Witton, Birmingham.—September stock list of a.c. motors and d.c. dynamos and motors.

MESSRS. E. P. ALLAM & Co., 107-109, Gray's Inn Road, W.C.1.—September stock list of d.c. motors for sale or hire.

THE PYRENE CO., LTD., 9, Grosvenor Gardens, S.W.1.—A pamphlet advertising "Pyrene" fire extinguishers.

MESSRS. BELLING & Co., Bridge Works, Southbury Road, Enfield.—A well-illustrated and priced catalogue of electrical appliances, including fires, water-heating apparatus, cookers, irons, &c.

TOK SWITCHES, LTD., Granville House, Arundel Street, W.C.2.—A blotter bearing a calendar for September and an illustration of a double-pole "Barrier" switch.

THE MILLNS ELECTRICAL CO., 17, Whitefriars Street, E.C.4.—Leaflet FV5501, advertising "Meco" electric forge blowers.

TUNGSTALITE, LTD., 47, Farringdon Road, E.C.1.—A net trade price list of electrical materials and appliances; and a retail price list of "Tungstalite" lamps.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—An illustrated and priced leaflet describing an anti-microphonic valve holder.

CONTRACTORS' SUPPLIES CO., 5, Finsbury Square, E.C.2.—A price list of electrical accessories, including tumbler switches, switch-plugs, lampholders, fuse-boards, &c.

THE BORDESLEY ELECTRICAL ACCESSORIES CO., LTD., 162, High Street, Bordesley, Birmingham.—A well-illustrated and priced catalogue of electrical and radio accessories.

THE ARORA CO., Rosebery Road, Loughborough.—A booklet containing illustrations, details, and prices of electric fires, including some new designs.

Bankruptcy Proceedings.—F. J. TIZZARD and N. TIZZARD (Tizzard Bros.), electrical engineers and contractors, 27, Dalkeith Street, Barrow-in-Furness, and 121, Market Street, Dalton-in-Furness.—First meeting, September 12th, at the Official Receiver's office, 16, Cornwallis Street, Barrow-in-Furness. Public examination, September 25th at the Magistrates' Court, Barrow-in-Furness.

W. H. MURAD (W. H. Murad & Co.), wireless manufacturer, 126, Princess Street, Manchester.—First and final dividend of 1s. 3½d. in the £, payable September 14th, at the Official Receiver's offices, Byrom Street, Manchester.

A. J. BARLOW (Barlow Bros.), 9, Brunswick Place, City Road, E.C.—Trustee, Mr. A. Willmott, 14, Old Jewry Chambers, E.C., released June 4th.

W. A. BEAUMONT, electrical engineer, 44, Warrengate, Wakefield.—Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield, released July 20th.

R. SHEARD (R. Sheard & Co.), 2, Market Street, and 86, Station Lane, Featherstone, Yorks.—Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield, released July 20th.

J. B. SHIELDS, plumber and electrician, 221 and 198a, Linthorpe Road, Middlesborough.—Last day for proofs for dividend, September 15th. Trustee, Mr. C. P. Barrowcliff, 55-57, Albert Road, Middlesborough.

G. W. HUMPHREY (Humphrey Electrical Co.), electrical engineer, 24, Broad Quay, Bristol.—Supplemental dividend of 2½d. in the £, payable at the Official Receiver's office, 26, Baldwin Street, Bristol.

J. H. HOPKINS (Electrical Maintenance Co.), 140, Wardour Street, W.C.—Trustee, Mr. M. Hyams, 60, Chancery Lane, W.C., released August 19th.

H. J. W. EMBURY and K. S. EMBURY (H. & K. Embury), electrical and mechanical engineers, 110 and 29, Queen Street, Newton Abbot.—Trustee, Mr. A. L. Honey, 23, Catherine Street, Exeter, released August 7th.

T. BARTON, electrical engineer, Electric Works, Ainsworth Street, Blackburn.—Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, appointed September 2nd.

Company Liquidations.—ARROTA ELECTRICAL & MOTOR ACCESSORIES CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. E. Cross, Fish Dock Road, Grimsby. A meeting of creditors was held on September 3rd. Particulars of claims to the liquidator by October 3rd.

ALKLUM ELECTRICS, LTD., Waterside Works, Waterside, Halifax.—The first meeting of creditors was held on September 2nd at the County Court House, Halifax. The statement of affairs showed liabilities of £75, and there were no assets. The issued share capital of the company was £1,000, so that there was a deficiency as regarded the contributories of £1,075. The company was incorporated on February 3rd, 1921, to carry on the business of general electrical engineers. It appeared, however, to have had no real trading existence owing, it was stated, to certain negotiations with a view to the introduction of capital by another firm having fallen through at the outset. As the company had, however, actually been floated, it was decided to experiment in and advertise accumulators only, with the object of creating a goodwill. It was alleged that the company did not manufacture accumulators, but that all orders received for the supply of accumulators were passed on to another company for execution, apparently without consideration. All the capital had been allotted as fully paid for cash. It was alleged that the company discharged all its liabilities, and when the £1,000 capital was exhausted early in 1924, it ceased operations, although the same advertisements were continued later, but to the order of the other company. On December 18th, 1924, the company was sued for £36 for advertisements and on March 31st, 1925, judgment was given for the plaintiffs for £36 and £38 14s. 7d. costs. The action was defended on the ground that instructions had been given to stop the advertisement. The failure of the company was attributed to efforts to obtain further capital being unsuccessful and also to the County Court judgment mentioned. The creditors resolved to appoint Mr. Theo Wm. Meldrum, C.A., of 73, Basinghall Street, E.C., as liquidator of the company.

WIRELESS EQUIPMENT, LTD.—A meeting of members is called for September 30th at Messrs. Corfield & Cripwell's offices, Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidator, Mr. W. A. J. Osborne.

Social Event.—On August 29th, the employés of Messrs. Robson & Coleman, Newcastle-upon-Tyne, and their friends spent a most enjoyable day at Ponteland. A party of about 100 accepted the invitation of the principal of the firm, Mr. R. E. Robson, to celebrate in this way the marriage of his daughter. Among the events of the day were sports and games, the prizes for which were provided by Mr. and Mrs. Robson, and presented by Mrs. Lowney.

Belgian Manufacturing Development. — A Belgian concern, Lorenz & Cie., has lately acquired a large area of land at Eupen on which to establish works for the manufacture of small electrical accessories of porcelain and copper, for which, it is stated, Belgium is still mainly dependent on imported supplies—articles coming chiefly from Germany.

Proposed Australian Tariff Changes.—Mr. H. E. Pratten, Commonwealth Minister for Trade and Customs, introducing the new Tariff Bill in the House of Representatives on September 2nd, said that there was no question that the action of Australia in giving preference to Great Britain ultimately led the Mother Country to grant a preference on some Australian products. The value of the imports last year, which would be affected by the proposed tariff increases, exceeded £30,000,000, while the value of those which would be affected by the proposed tariff reductions was £10,000,000. The 275 items and sub-items hitherto admitted free from the United Kingdom would now be increased to 311 and the ratio of British preference would be maintained or increased under the present proposals. The principal increases in the British, intermediate, and general tariffs respectively would be as follows: Machinery, including locomotives, mining machinery, and dynamos of over 75 kW, 12½, 15, and 15 per cent. respectively; other machinery, and dynamos of up to 75 kW, 17½, 20, and 20 respectively; iron and steel plate and galvanised sheets, unchanged, 27s. 6d. and 30s. per ton respectively; X-ray transformer apparatus, at present free, 10 and 20 per cent. respectively, would now be 27½, 35 and 40 respectively. Mr. Pratten said the proposals were expected to result in a considerable increase of employment throughout the Commonwealth. The value of the present wide preference to British goods was increased by over half a million. The Government was showing in a practical manner its appreciation of the Imperial Government's action in extending a further preference to Australian products. In a few cases the preference to Great Britain was abolished because the trade in these particular items was negligible. The proposals would also further stimulate *bonâ-fide* British industry.—*Reuter* (Melbourne).

German Tariff Modifications.—The following German tariff modifications are included in a list published by the *Board of Trade Journal*: "Blocks, sheets and rods for electro-technical purposes, merely roughly stamped, graphited or not," 75 Reichsmarks per 100 kg. "Electrodes: Not graphited, weighing each 3 kg. or more, 7 Rm. per 100 kg.; graphited, weighing each 3 kg. or more, 175 Rm. per 100 kg." "Vulcanised fibre slabs, 3 mm. or less thick," 20 Rm. per 100 kg.

Book Notices.—"The Pirelli-General Cable Book" (291 pp., illustrated). Southampton: Pirelli General Cable Works, Ltd.—This handsomely produced volume is a mine of information relating to the construction and working of cables —particularly those with paper insulation. An introductory portion contains a description of the company's works at Southampton—a subject with which we deal elsewhere in this issue—and then the various processes in the manufacture of the cables are mentioned. Particulars are given of important contracts which the company and its parent company Pirelli & Co. (Milan) have carried out. The bulk of the publication is devoted to practical information concerning the testing and installation of the cables. Protective systems are described and a great mass of tables and statistics are included. Separate sections contain details of telephone cables, vulcanised bitumen and vulcanised rubber cables, as well as instrument and machine-coil wires. The book is profusely illustrated with views of the works, installations, joint boxes, &c. There is also a good deal of general data upon metals and dielectrics.

"The *Journal* of the South African Institution of Engineers." Vol. XXIV, No. 1, August, 1925. The Institution. Price, 2s.

"Alternating Current Problems," by R. E. Brown. Pp. viii + 84; figs. 16. London: Chapman & Hall. Price 6s. net.

"Circular No. 271 of the United States Bureau of Standards," "Master Specification for Rubber Gloves for Electrical Workers." Pp. 7. Washington: Government Printing Office. Price 5 cents.

"*Proceedings* of the Rugby Engineering Society, Session 1923-24." Vol. XVIII. Published by the Society. Price 10s. 6d.

"The *Transactions* of the South African Institute of Electrical Engineers." Vol. XVI, Part 6, July, 1925. The Institute. Price 2s.

"Science Abstracts" (A and B). Vol. XXVIII. Part 8. August 25th, 1925. London: E. & F. N. Spon, Ltd. Price 3s. each net.

"Electrical Engineers' Data Books." Vol. I. "Lighting, Traction, and Power Distribution," by E. B. Wedmore and D. V. Onslow. Pp. xxi+825; figs. 203. Vol. II, "Manufacture, Design, and Laboratory Work," by E. B. Wedmore and D. V. Onslow. Pp. xxi+470; 151 figs. Vol. III, "Radio Engineering," by E. B. Wedmore and J. H. Reyner. Pp. xxii+462; figs. 314. London: Ernest Benn, Ltd. Price 15s. each.

Prussian State Interests.—The State of Prussia, which recently acquired a large financial interest in the Rhenish Westphalian Electricity Works Company, is now participating in a syndicate which is taking over the undertaking of the Siemens Electrical Works Co., of Hamburg, which controls various supply undertakings. The shares purchased by the syndicate represent 4,000,000 marks, which amount is to be increased to 8,000,000 marks and to be taken over also by the syndicate. The sellers are the Siemens and Halske Company and the Swiss Electrical Industry Company, which held 1,250,000 marks of the total share capital.

Water Turbines for Norway.—The Norwegian Storting recently voted an additional sum of 5,200,000 kronor for the accelerated extension of the State hydro-electric works at the Nore, this making a total sum of 9,700,000 kr. granted this year for the execution of works. The further outlay on the works will amount to 17,000,000 kr. in 1926 and 10,000,000 kr. in 1927, it being expected that the undertaking will be completed in 1928. Tenders are now being invited for the supply of two additional turbines. The order for the first turbine was placed in Germany some time ago, a German firm having quoted a price which was 280,000 kr. below that of competitive Norwegian works. Asked whether the new orders would be allotted to German works, the Director of the State Water Power Department is reported to have stated that he was unable to give a reply. He believed, however, that the appreciation of the Norwegian krone would render it more difficult for Norwegian works to tender than on the former occasion.

Telephone Apparatus Manufacture in Spain.—According to a Madrid economic journal, Spain is to be placed in the position of being able to manufacture all the telephone material required in order to carry out the important programme which has been formulated by the Spanish National Telephone Company. This information is said to have been confirmed by a cable received from the president of the International Telephone and Telegraph Corporation, which indirectly controls, among others, the existing telephone factory at Barcelona. It is now proposed to establish in Madrid or vicinity a large works capable of not only supplying the needs of the Spanish market, but also able to export, particularly to South America.

Patent Rights in Russia.—It is reported that the Soviet authorities have notified foreign inventors and patentees that under the new patent law adopted last year patents issued and registered in Russia under the old *régime*, or applied for prior to November 7th, 1918, should be re-submitted to the Inventions Committee, 76, Fontanka, Leningrad, for renewal. It is understood that applications for renewals may be made up to September 25th next and that they should be submitted through some representative residing in Russia.

Re-grading of Worcester Undertaking.—At a meeting of the City Council last week the Council agreed to the transfer of its electricity undertaking to Class D of the National Joint Board's schedule. The salaries affected will be increased by a total of £240.

The British Industries Fair.—A *Times* correspondent says that it is authoritatively stated that the Treasury has decided to make a grant of £20,000 to assist in the promotion of next year's British Industries Fair. The probable period of the holding of the London section will be from February 15th to 26th next.

Cuban Import Duties Increased.—The *Board of Trade Journal* reports that import surtaxes are to be imposed on all classes of goods by the Cuban authorities. "Luxury" articles are to bear a surtax of 10 per cent.; the rate in the case of all other goods is 3 per cent.

Belgian-Dutch Lamp Agreement.—It is reported from Amsterdam that the Philips Glowlampworks Co. has concluded an agreement for community of interests with La Lampe Electrique Belge. The latter has acquired the Philips' patents and will increase its output to 1,500,000 lamps per annum.

United States Radio Exports.—A review of the United States exports of radio apparatus during the first six months of the current year shows that the total value was $4,068,442, as compared with $1,826,246 in the first half of 1924, and $6,030,914 for the whole of that year. Japan became the most important customer, taking goods to the value of $1,238,030 (as against $60,415), while Canada, with $852,783 (as against $705,287), fell to second place. The principal European customer was Great Britain ($212,958, as compared with $48,074), Spain being second with $164,132. In the Latin-American market Argentina ($237,609) and Brazil ($227,399) were the leading customers. The Australian and New Zealand market absorbed apparatus to the value of $375,380, as compared with $190,665 in the first half of 1924.

The Leipzig Fair.—According to the papers, business during the first day of the Leipzig Fair was chiefly in necessary supplies. Considerably better trade was done at the technical and building fairs. The second day brought no marked change, satisfactory business being transacted in certain sections. Among foreign sales were household appliances for Australia. Home customers as a rule bought only moderate quantities and preferably the cheaper articles.—*Reuter's Trade Service* (Berlin).

Osmiridium Mining in Tasmania.—A Victorian company, with a capital of £30,000, has been formed for the purpose of mining osmiridium from rock at Waratah, in Tasmania. This is stated to be the only place in the world where osmiridium is found.—*Reuter's Trade Service* (Melbourne).

Illumination in South Africa.—During the recent visit of the Prince of Wales to South Africa many local authorities bestowed special care and ingenuity upon the decoration of their towns. One of the most interesting instances of this was

The Illumination of Church Square, Pretoria.

Pretoria, where extensive use was made of electric light. The accompanying illustration is a night view of one side of Church Square, Pretoria, the outlines of the buildings being picked out with "Osram" lamps.

Hydro-Electric Development Tax in Porto Rico.—A law has been passed by both Houses of the Porto Rico Legislature levying a tax of one-tenth of 1 per cent. on all real property in the island for a period of three years, in order to provide a fund, which it is estimated will approximate $500,000, for the development of hydro-electric power. This has not, as yet, been signed by the governor, but it is thought that he will approve the Bill.—*Commerce Reports.*

Electrical Appliances for Uruguay.—*Commerce Reports* says that there is a considerable market in Uruguay for electric reflector-type heaters rated at 1,000 W or less, as well as some market for small electric cooking stoves and self-contained cooking devices.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from September 2nd :—

Ford. No. 454,460. Class 6. Magnetos and dynamos for motor cars, electric starting and ignition machinery, &c., and parts of such goods. No. 454,461. Class 8. Electric batteries and accumulators, electric ignition coils and parts thereof, &c. No. 459,575. Class 13. Electric switches, electric lamps and bulbs, sparking plugs, electric horns, &c. No. 459,577. Class 18. Electric lighting sets for motor vehicles. No. 459,580. Class 50. Batteries, boxes of wood, &c.—The Ford Motor Co. (England), Ltd., Trafford Park, Manchester.

Frelat (lettering and design). No. 454,924. Class 8. Wireless telephonic and telegraphic apparatus.—Naamlooze Vennootschap Frelat Export MIJ. 69, Singel Amsterdam, Holland (J. W. Wilson & Co., 55, Market Street, Manchester).

Valoc. No. 457,866. Class 8. Crystal detectors and detector crystals for use in wireless telephony.—Leslie Gerald Russell, 1-7, Hill Street, Birmingham.

Radio-pal (lettering and design). No. 458,532. Class 8. Portable wireless receiving apparatus. Multistat (lettering and design). No. 458,533. Class 8. Control instruments for wireless transmitting and receiving apparatus.—Joseph A. Bower, trading as J. A. Bower, 7-8, Great Winchester Street, London, E.C.2.

Saxoflex. No. 450,687. Saxbestos. No. 450,688. Class 8. Electrical cable. —Louis Henry Euler, 54, Inchmery Road, Catford, S.E.6.

Siftron. No. 460,848. No. 460,911. Same lettering combined with design. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Edward A. Graham, trading as Alfred Graham & Co., St. Andrew's Works, Crofton Park Road, London, S.E.4.

Patent Application.—Application has been made for the restoration of patent No. 123,545 of 1917, granted to W. E. Prescott and G. R. Baker for "Electrical apparatus for subjecting articles to varying temperatures."

New French Companies.—A new company has lately been formed in Paris (9, Boulevard Denain), with a capital of one million francs and the title La Société de l'Energie Electrique d'Isère et de Drome, to establish a hydro-electric power station on the River Ebron in the Department of Isère.

La Société Electrique de Travaux Agricoles is the name of a new undertaking which has lately been organised in Paris (67, Rue de Dunkerque), with a capital of one million francs to develop the use of electrical appliances in agricultural operations.

A new company has lately been formed in Grenoble (27, Rue de Turenne), with a capital of 220,000 fr. and the title La Société du Barrage de Sechilienné, to establish a hydro-electric station on the River Romanche at Sechilienne, in the Department of Isère.

La Société Radio-Electrique is the name of a new company which has lately been formed in Nantes (2, Rue Sully), with a capital of 200,000 fr., to engage in the wireless industry in Western France.

La Société Nord-Africaine d'Electricité is the name of a new company which has lately been formed in Paris (94, Rue de la Victoire), with a capital of 300,000 fr., to establish electricity undertakings in North Africa.

A new company has lately been formed in Paris (56, Rue du Faubourg, St. Honoré), with a capital of 500,000 fr. and the title La Société des Relais à Arc to acquire and exploit the Dunoyer and Toulon arc relay patents.

Electric Washers in America.—The *Electrical World* states that a banking firm has issued a special bulletin dealing with the American clothes-washer industry. This states that it is estimated that in 1914 there were 50,000 electric washing machines in use in the United States, valued at $5,000,000, while ten years later, in 1924, there were more than 4,000,000 such machines, valued at over $600,000,000. The average value of each machine is estimated at $150. At the current rate of consumption and allowing for wear and tear, it is estimated that in 1929 there will be over 7,600,000 washing machines in use in 22,850,000 wired homes, valued at over $1,100,000,000, or thirty-three for every hundred wired homes. If this rate is increased to even forty in every hundred, as it well might be, the total number of electric washing machines will exceed 9,000,000 or over, twice the number now in everyday use. Placing the life of an electric washer at ten years, it is obvious that the replacement requirements alone four years from the present time will reach over 700,000 machines, or more than has been produced so far in any one year by the industry. Out of about a hundred companies manufacturing electric washing machines in the United States, there are to-day three which are furnishing 46 per cent. of all the machines now on the market.

Belgian Exhibition Postponed.—According to the *Bulletin* of the Société Belge des Electriciens it has been decided to postpone until 1930 the international electrical exhibition which it was proposed to hold in Brussels next year in order not to clash with the Independence Centenary Exhibition.

New Italian Companies.—Among the new companies recently formed in connection with hydro-electric developments in Italy are the Società Idroelettrica Alpi Maritime, Milan, capital 100,000 lire, to establish plants to utilise the water power of the Rivers Nervina, Nervia, Gordali and Tenarda in the Maritime Alps; the Società Idroelettrica di San Filippo, organised at Contigliano with a capital of 50,000 lire; the Società Idroelettrica Stura, Milan, capital 100,000 lire, to establish a plant in the Lanzo Valley (Stura); the Società Forze Idrauliche del Lago di Molveno, Milan, capital 1,000,000 lire, to utilise the water power of Lake Molveno; the Società Idroelettriche Alto-Caffaro, Milan, capital 100,000 lire; the Società Forze Idrauliche del Rovico, Milan, capital 400,000 lire; and the Società per le Forze Idrauliche del Piceno, Milan, 100,000 lire.

Japanese Telephone Development.—The Japanese Department of Communications has decided to allot 5,000 new telephones a year to the city of Osaka, beginning this year. This will entail the opening of an additional exchange yearly for several years. The Japanese telephones are of the automatic type, and the system adopted is the Strowger system, which is approved by the British Post Office. Much of the equipment required will be supplied by British manufacturers.

Indian Electrical Imports. — Our Indian correspondent says that during the quarter from April to June, the total electrical imports into India amounted to Rs. 113 lacs, as against Rs. 1 crore in the corresponding quarter of 1924. Electrical machinery remained almost unchanged at Rs. 55 lacs, but electrical instruments and apparatus showed a rise as compared with the past year's corresponding quarter from 46 lacs to 59 lacs. In the case of electrical machinery, the decline was chiefly due to decreases in "Generators, alternators, &c.," from 11 lacs to 7½ lacs., and "Motors" from 12 lacs to 9 lacs. "Control and switchgear" increased from 9 lacs to 11½ lacs, and "Turbo-generating sets" from 1½ lacs to 3½ lacs. There was also an increase of two lacs in the miscellaneous items. The principal supplier was, of course, the United Kingdom, supplying 46½ lacs worth of machinery out of the total of 54 lacs, but Germany showed some progress from about one lac to 2½ lacs. The position of the United States remained the same. In the case of electrical instruments and apparatus the main increase was under "Wires and cables," from 12 lacs to 19½ lacs. "Electric fans and parts" increased from 8 lacs to 10 lacs, "Electric glow-lamps" from 3 lacs to 5 lacs, and "Electric lighting accessories" from 3 lacs to 5 lacs. The increase recorded on the whole is spread over all the supplying countries. The United Kingdom supplied 41 lacs worth of goods as against 31 lacs in April-June, 1924; Germany increased her share from 5½ to 6½ lacs; the Netherlands from about 2 lacs to about 3 lacs; and the United States remained at 4½ lacs. As new projects are maturing in India, there is reason to think that this expansion in trade will be kept up.

German Power Fuel Syndicate in Australia.—The *Melbourne Herald* says that the representative of a German syndicate which proposes to establish a factory for the production of power fuel and chemical products by a secret process is now in Australia.—*Reuter's Trade Service* (Melbourne).

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report, September 8th :—Copper (electrolytic) bars, £69, 30s. increase; do., do., sheets, no change; do., do., wire rods, £79, 30s. inc.; do., do., h.c. wire, 9¾, 3/16 increase.

Messrs. James & Shakespeare report, September 8th :—Copper bars (best selected) sheet and rod, £93, £1 increase; English pig lead £39 10s., 10s. decrease.

Messrs. Edward Till & Co. report, September 8th :—India-rubber, Para fine, 3s., 1d. to 2d. decrease.

Trade with Western Canada.—The *Board of Trade Journal* reproduced recently a report by the Senior Trade Commissioner in Canada (Mr. F. W. Field) upon trade prospects and conditions in Western Canada. He states that United Kingdom manufacturers, as a whole, appear to possess inadequate knowledge of the conditions prevailing in Western Canada, although there are a few successful exceptions. The importance of delivery according to promise and compliance with instructions is emphasised, and it is urged that the subject of packing should be given greater attention. In this connection it is interesting to note that Mr. L. B. Beale, British Trade Commissioner at Vancouver, who has charge of the Western Canadian offices, is at present in the United Kingdom to confer with manufacturers and merchants with a view to advising them as to the Canadian market. Those desiring to meet Mr. Beale should immediately apply to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Local Exhibition.—WAKEFIELD.—The Electricity Committee has agreed to a scheme prepared by the Electrical Engineer for an electrical exhibition during the autumn.

Cable Manufacture in Czecho-Slovakia.—It is announced from Prague that the Bratislava Cable Works Co., of that city, has just acquired a large area of land in the town of Kolin on which to establish a branch factory.

Australian Tariff Decision.—Among the recent decisions of the Australian Tariff Commissioners is the following :—"Cable, telegraph and telephone, paper insulated, lead covered and served, Item 181 (A) : free under the British preferential tariff; 5 per cent. under the intermediate tariff; and 15 per cent. under the general tariff."

German Electrical Exports.—In the course of a report upon German foreign trade in July recently forwarded to the Department of Overseas Trade by Mr. J. W. F. Thelwall (Commercial Secretary at Berlin), it is stated that the exports of electro-technical products increased by 10 million Reichsmarks as compared with the June value.

Swiss Electrical Imports.—Figures just to hand show that the exports of electrical machinery from Switzerland during the first half of the current year attained a value of £552,320, as compared with £419,320 in the corresponding half of 1924. Although France continues to be the principal market, the demand from Spain has lately considerably increased, while an improving business is being done in Norway and Poland.

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Cable Manufacture at Southampton.

The Pirelli-General Cable Works.

AMONG the places of interest to which visits were paid by members of the British Association during the course of the annual meeting at Southampton, was the Pirelli-General Cable Works, one of the most important industrial establishments in the town.

This factory is situated on the Western Shore by the walls of ancient Southampton, and within a few hundred yards of the two Southern Railway stations. Being of fairly recent erection, the factory is laid out on modern lines, substantially built, and equipped with up-to-date machinery for the manufacture of every description of cable and particularly for paper-insulated, lead-covered and armoured types. An aerial photograph of the works is reproduced in fig. 1.

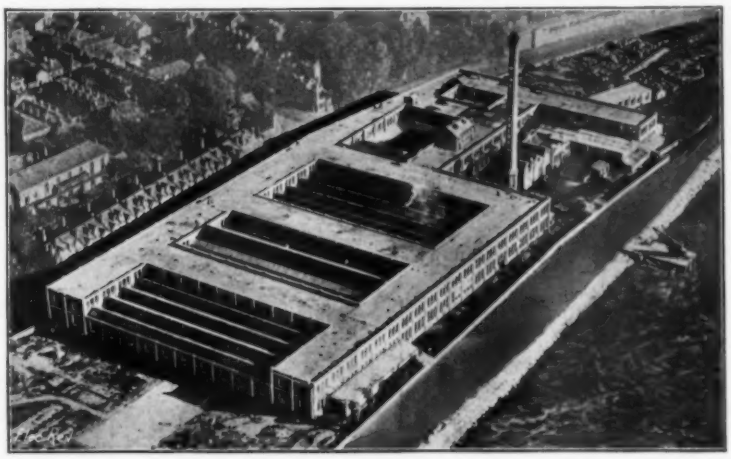

Fig. 1.—Aerial View of the Pirelli-General Works.

The works is supplied with wire by the company's Eastleigh factory situated on the Southern Railway about five miles distant. Thus the processes at the Southampton works commence with the stranding of the cable. For this purpose, a number of heavy and light stranding machines, both horizontal and vertical, have been installed; some of these are to be seen in the view of the main shop which is presented in fig. 2.

All material required in the manufacture of the cables is tested upon entering the factory. For this purpose a spacious laboratory (fig. 3) has been provided with all the necessary equipment. In addition to this testing, a great deal of research work is carried out in the laboratory.

One of the principal jobs which was in process during the British Association visit was the manufacture of a 33,000-V cable. After the wires are stranded, they pass through a paper-lapping machine and receive numerous layers of paper; the three cores are then laid up together and the spaces between them are filled up with paper twisted into the form of a cable. Further paper is lapped on to bind the cores and fillings together and give the cable a circular section. The cable is then run into a steam-heated drying chamber and later immersed in a tank of special impregnating compound under vacuum. The cable next passes to the lead press (fig. 4). Entering through a guiding die the cable is surrounded by lead in a semi-plastic state under pressure. It is then forced through dies of the dimensions necessary to give it a sheathing of the correct thickness for the particular size of cable being covered. The cable next passes through cooling troughs, after which it is wound on a steel drum. The drum and its contents are then taken to the testing tanks (fig. 5), which are situated close to the lead presses to reduce handling to a minimum, and the cable remains immersed in water for 24 hours. At the expiry of this period, the pressure tests prescribed by the British Engineering Standards Association are applied from the test room which adjoins the tanks. The test room is equipped with all the necessary instruments and appliances for testing the great variety of cables which arrive at this point in the course of their manufacture, to be proved before passing to the armouring and finishing machines. In addition to a pressure test, the insulation resistance, the capacity, and the resistance of the conductors are determined. A high insulation resistance does not necessarily imply that the cable is a good one; it very often indicates the reverse. In addition to these tests a bending test is often specified in accordance with the British Standard Specifications dealing with the testing of cables. To carry this out, a sample of the cable of a length not less than 60 times the overall diameter of the cable is bent round the barrel of a drum three times in one direction and three times the reverse way, the diameter of the barrel being twelve times the overall diameter of the cable. After this the cable is subjected to a high-pressure test, and in no case should it break down at less than the specified B.E.S.A. test pressure; Pirelli cables, we are assured, always withstand a much higher pressure. The tests mentioned above are quite satisfactory so long as the cables are for voltages within the limits for which the B.E.S.A. has issued specifications, but for higher working pressures other features assume great importance. For instance, in the case of a cable for a working pressure of 33,000 V, which is now becoming standard in this country, a very high voltage test is not considered desirable, and it is not recom-

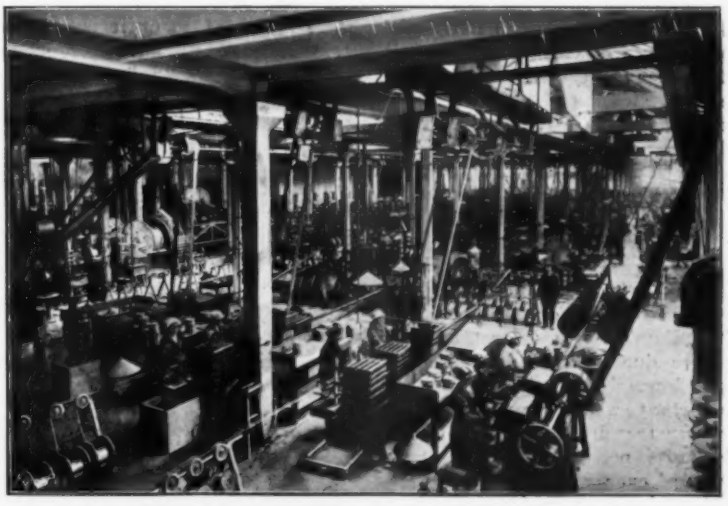

Fig. 2.—View of the Main Shop.

mended that the test shall be at more than 2½ times the working pressure. The bending test is also very important, and after carrying out the bending operations previously specified, the cable should not break down at

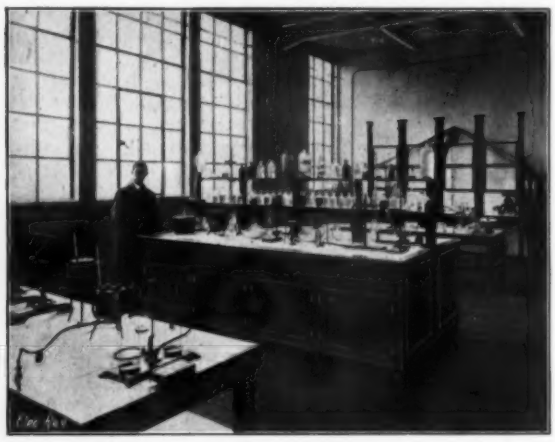

Fig. 3.—Chemical Laboratory.

less than four times the working pressure. A test which is recognised to be of great importance for very high voltage cables, is that of the measurement of the dielectric losses. In the technical section of the company's

Fig. 4.—Lead Presses.

handbook, to which we are indebted for these details of tests, curves appear showing the dielectric losses on various types of cables. Whilst these losses are themselves an indication of the soundness or unsoundness of the cable, too much stress should not be laid on them, as although it is true that a cable with high dielectric losses is not a good one, it can equally be true that a cable with extraordinarily low dielectric losses is not necessarily a better cable than one in which the losses are within certain defined limits. Furthermore, the actual loss of power due to normal cable dielectric losses is, to a great extent, unimportant when compared with the power transmitted by the cable. It is quite possible for a greater amount of energy to be lost in the lead sheathing than in the dielectric.

The armouring may consist either of steel tape or iron wire and after passing through this process a layer of jute is usually served upon the cable. The latter is then wound on wooden drums and delivered to the dispatching department; here the drums are battened down, marked and lifted by overhead travelling cranes on to trucks or lorries for dispatch.

A large section of the factory is devoted to the production of dry-core telephone cables in a similar continuous and progressive manner. The individual core wires are wrapped with paper of distinctive colours, and the next machine lays up the required number of pairs together, giving the correct length of lay to each layer, and the whole of the cores are then bound together with an outer paper wrapper (see fig. 6). They then follow the course of the power cables, through the drying ovens, lead presses, and testing tanks, omitting, of course, the impregnation processes. In this type of cable the paper insulation may be applied either helically or longitudinally and held in position by a cotton or flax lapping. The special feature of the construction of the cable is that it permits a third circuit to be superposed on each two-pair core, thus increasing the number of circuits by 50 per cent. In operating a cable in this manner it is important that the overhearing between the circuits shall be so small as not to interfere with the satisfactory working of the cable. This is especially important in a cable with a high transmission efficiency, both on account of the lower attenuation constant of such cables and on account of the fact that they are usually "loaded" and consequently have a higher impedance and operate at a higher voltage. To ensure that overhearing between the circuits shall be small, it is necessary that the electrical constants of the cable shall be

Fig. 5.—Testing Tanks.

uniform, and particularly that there shall be no resistance or capacity unbalance. These can be considerably reduced by care in manufacture, but it is also necessary

Fig. 6.—Insulating Air-spaced Telephone Cable.

to employ special methods when installing the cables to ensure that these "unbalances" are reduced to a minimum. The use of superposed circuits has considerably increased the number of circuits which can be contained in a given size of sheath. This increase in the circuit capacity of a cable has made essential a higher standard of maintenance than has hitherto been necessary. Modern methods of drying and special precautions during manufacture and installation have to be taken to enable the high insulation resistance required by the General Post Office to be obtained.

Fig. 7.—Rubber Mixers.

Another extensive portion of the works carries out the production of rubber-insulated cables, including telephone cords and flexibles. The rubber mixers are illustrated in fig. 7. A special formula is followed in the preparation of the rubber compound, but the sulphur necessary in the vulcanisation process is added in such a way that subsequent heating effects thorough and uniform vulcanisation. The wire used in these cables has, of necessity, to be tinned; this is carried out at the Eastleigh works. When the wires have been stranded, a coat of pure Para rubber is first applied, in the form of a tape about 2 in. in width. Covers of rubber compound are then applied, and the cable is subjected to heat to convert its covering into a solid vulcanised mass. One of the most interesting of the subsequent processes is the braiding. The company has a very large number of braiding machines (fig. 8), the bobbins of which wind in and out at a great speed, producing a closely-woven cover of cotton. This section gives a relieving touch to the general drabness of the factory, for cottons and silks of a variety of hues are employed in the braiding process.

Fig. 8.—Braiding Machines.

Mention must be made of the Social Club which the works staff has organised, and for which the company has provided accommodation at the western end of the works. Tennis, football, cricket, sailing, and photography are all included and catered for, and during the winter months successful dances are held.

An All-Electric Housing Scheme.

Particulars of the Glasgow Corporation's Electrically-Equipped Houses.

By R. HARDIE.

It may be recalled that as early as 1915 Mr. George Hamilton, a Glasgow builder, erected some thirty 4- and 5-apartment bungalows, equipped throughout with electric lighting, heating, cooking and water-heating apparatus. After ten years these houses and their equipment remain a tribute to the enterprise and foresight of that now almost extinct individual, the private builder. The people of Glasgow are wont to claim that Lord Kelvin's house was the first electrically lighted house in the world, and it is thought that Mr. Hamilton's electric houses in the Dumbreck suburb of Glasgow were amongst the first chimney-less houses in this or any other country. All honour to this pioneer builder who had the enterprise, or temerity as it was looked upon in those days, to provide this early object lesson on the value of labour-saving houses. To-day the local authority is usually entrusted with the erection of houses, and the 290 houses described herein are the first completed all-electric houses erected by the Glasgow Corporation. A further 510 similar houses have been authorised, and are at present in the process of erection. Each house is furnished with electric lighting throughout, an electric cooker, a wash boiler, and provision for electric fires in all rooms except the living room. The houses are 3-, 4- and 5-apartment buildings situated at Mount Florida and Possilpark. Each 3-apartment house consists of a living room and two bedrooms; the 4-apartment houses each comprise a living room and three bedrooms, while

Fig. 1.—All-Electric Houses at Mount Florida.

each of the 5-apartment houses contains a living room, a sitting room and three bedrooms. Every house also has in addition a bathroom and a " kitchenette."

A 7-kW electric cooker of the Glasgow Corporation's standard hiring type, complete with a three-pint copper electric kettle, 800 W, is part of the equipment of each house. A cast-iron wash boiler fitted with a 4-kW immersion heater is also installed, and it is interesting to note that for over a year not a single case of breakdown in the heaters has occurred, although they have in several instances been allowed to remain on circuit for many hours with the boiler not in use. Under normal conditions an abundant supply of hot water is obtained from the living-room coal fire, which, due to the rigour of the Scottish climate, is necessary throughout the greater part of the year. In several houses immersion heaters in the storage cylinders, for hot water supply when the coal fire is out of use, have been installed at the consumer's expense. Heating sockets are installed in all the rooms except the bath and living rooms to specification, but in many cases the tenants have had sockets fitted in the remaining rooms at their own expense. In fig. 4 is shown a view of one of the bedrooms equipped with the following electrical apparatus: bedwarmer, hair dryer, curling tongs and comb, violet-ray apparatus, trouser press, kettle, table lamp and fire. In addition, a socket for an electric iron is provided, usually in the kitchenette or living room. Electric fires are provided as follows: one 2-kW fire in each 3-apartment house, two 2-kW fires in each of the 4-apartment houses, and two similar fires and one of 1 kW capacity in each of the 5-apartment houses. The entire electrical equipment is provided by the Housing Authority, and there is no hire charge payable by the tenant. The electricity department undertakes the maintenance of all electrical heating and cooking apparatus in the houses. This cost has been found negligible except in the case of the cookers, but with improved types of cookers it is hoped shortly to eliminate, or at least reduce, the cost under this head.

Fig. 2.—An Electric " Kitchenette."

The tenants have the option of being charged at a flat rate of 4½d. per kWh for 730 hours' use per annum of the maximum demand, which in the case of a 3-apartment house is 70 kWh per annum; a 4-apartment house, 100 kWh; and a 5-apartment house, 150 kWh, all over this quantity being charged for at ¾d. per kWh; or a fixed service charge per month, plus ½d. per kWh for all energy consumed. The fixed charge for a 3-apartment house is 6s. 6d.; a 4-apartment house, 7s. 7d.; and a 5-apartment house, 8s. 8d. per month. The majority of the tenants take advantage of the latter scale, its simplicity appealing to them. The returns of the electricity department show that the average weekly bill for a 3-apartment house is 3s.; 4-apartment house, 3s. 6d.; and a 5-apartment house, 4s. 6d. These figures confirm the fact that electrical service has nothing to fear from close comparison on the score of cost with the older methods of lighting, heating and cooking, which it is gradually superseding.

Fig. 3.—One of the Living Rooms.

Fig. 4.—An Electrically Equipped Bedroom.

The Director of Housing estimates that the saving effected in building construction due to the elimination of fireplaces amounts in the case of a 3-apartment house to £27 10s., and in that of a 4-apartment house to £34; which means that a house to-day can be built and equipped with electrical apparatus, including cooker,

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wash boiler, and electric fires, as cheaply as a house without these conveniences. An appreciation of this, coupled with the fact that the houses, when built, can be operated at a cost within the means of the average tenant, should lead to a speedy extension of this type of house in the immediate future. The latter condition is, of course, dependent upon the price of electricity in the area, but a growing number of authorities, both municipal and company, in view of the growing appreciation of the possibilities of the domestic load, are now offering electricity at terms which may be considered attractive.

As stated, there are no open fires or fixed fireplaces in any of the rooms apart from the living room, and the resultant additional wall space available in the rooms is much appreciated by the tenant. The rooms are found to be efficiently heated by the electric fires provided, and the absence of the usual accompaniments of the coal fire (ashes, dust and smoked ceilings) is very noticeable. The average height of the ceilings is 8 ft. 6 in., and each room is ventilated by means of a ventilating grating near the ceiling, leading into a ventilating shaft.

Whilst pressing for this business, the Glasgow Electricity Committee urged the desirability of demonstrating on a somewhat larger scale than had been hitherto possible, that an electric house would prove satisfactory to the occupants, and what is important, the running cost would be moderate and well within the means of those who occupied the houses. It was confidently anticipated that the bulk experience gained would confirm that previously obtained in individual cases, and do much to remove the impression generally held that electricity was expensive. More than 100 of the houses have now been occupied for twelve months, and there is no reason to doubt the accuracy of this contention. The occupants themselves, mostly from houses with gas installed, are thoroughly satisfied, and the undertaking's demonstrator, who keeps in touch with them from the date of entry, reports that they fully appreciate the change-over, and experience no trouble whatever in operating the electrical apparatus.

Fig. 2 shows a view of the kitchenette of one of the all-electric houses, from which it will be seen how conveniently spaced and wired for is the electrical equipment. A view of one of the living rooms with an electric fire installed appears in fig. 3, while fig. 1 gives a general view of the houses at Mount Florida.

Lighting and Power Notes.

Australia. — GREATER BRISBANE. — After conference with representatives of the Brisbane Tramway Trust, the Electric Light, Power and Transit Committee of the Greater Brisbane Council has recommended that, before proceeding with the erection of a large power house, negotiations shall be entered into with the City Electric Light Co., with regard to acquisition of the company's undertaking.—*Electrical Engineer of Australia and New Zealand.*

Basingstoke.—LOAN.—The Town Council has applied for sanction to a loan of £1,600 for extending the supply of electricity to Old Basing and district by means of overhead cables.

Bexhill.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. C. A. Frost) for the year ended March 31st, 1925, record a total revenue of £30,242, as compared with £27,325 in the preceding year. Working expenses amounted to £17,910, as against £16,808, leaving a gross profit of £12,332 (£10,517). After providing for capital charges, a net surplus of £3,709 remained, as compared with £959 in 1923-24. The capital expenditure during the year amounted to £15,006. The electrical energy sold increased from 1,244,774 to 1,470,012 kWh, and the maximum supply demanded from 965 to 1,115 kW. The Electricity Commissioners have refused to sanction the installation of additional generating plant at Ashdown Road, and an agreement has therefore been entered into with Hastings Corporation for a bulk supply. Sanction has been received to install two 750-kW motor converters with the necessary switchgear, for this purpose.

Blackburn-Preston.—LINKING-UP SCHEME.—The linking-up of the power stations at Blackburn and Preston with a high-voltage cable has been commenced. Work was started at Hoghton, which is about midway between the two towns, and the cable is being carried in the direction of Blackburn first. The work will take about four months to complete. The Leyland cable is nearly finished, and it is expected that it will be available for service by about the beginning of November.

Colchester.—LOAN.—The Town Council has decided to borrow from the Ecclesiastical Commissioners £130,000 for its new electricity works. The new works are now in course of erection at the Hythe, Colchester.

Continental.—PORTUGAL.—The Government, having decided to encourage the construction of hydro-electric works, has granted a concession to the Companhia das Quedas d'Agua do Norte de Portugal for the development of power from the waters of the Cavado and Rabagao rivers. It is proposed to establish the first central power station at Villa Nova, where the two rivers meet, to supply 13,400 h.p. It is hoped, however, by the fuller utilisation of the two rivers, to increase the output to 42,000 h.p. Similar work is to be undertaken on the Paiva River, from which it is expected to obtain from 8,000 to 20,000 h.p., as development proceeds. The northern hydro-electric installation will be completed in five years, and the scheme will be financially supported by the Government, an influential group of French financiers and local firms. To finance the second project, a syndicate has been formed by the Companhia do Credito Predial Portuguez and the Banco Ultramarino.—*Reuter's Trade Service* (Lisbon).

ITALY.—The Societa Generale Elettrica Tridentina plans to erect two new power plants, capable of generating about 230,000,000 kWh per annum. They will cost about 100,000,000 lire.—*Commerce Reports.*

AUSTRIA.—A new hydro-electric power station has recently been completed and put in operation at Gampadel, near Montafon. The plant comprises two 4,500-kVA turbo-generators, space being provided at the station for the installation of a third set of similar capacity at a later date. Energy is generated at 6,000 V and stepped up to 45,000 V for transmission purposes.

RUMANIA.—A scheme is under consideration for the establishment of a plant to utilise the water power of the River Jalomitza between Scopoasa and Tatinculni. Half the energy generated would be reserved for traction purposes on the Roumanian State railways and the remaining portion transmitted to Bucharest for lighting and power purposes.

Crediton.—ELECTRICITY IN BULK.—At a meeting of the Urban District Council on August 31st, a report was submitted on the negotiations with Exeter Electricity Committee relative to a bulk supply of electricity to the district. It was stated that the Committee had reduced the minimum charge to £250 for the first year, £300 for the second year, £350 for the third, and £400 for the fourth. The Council has accepted the Committee's terms.

Dorking.—PROPOSED PURCHASE OF UNDERTAKING.—The Urban District Council is considering the purchase of the local electricity undertaking, operated by Messrs. Edmundson's Electricity Corporation, Ltd., under an agreement. The present contract expires in 1928.

Elland.—ELECTRICITY SUPPLY.—Subject to the Halifax and Huddersfield Corporations agreeing, in connection with the linking up scheme, to lay cables on brackets outside Elland Bridge, the Urban District Council has decided to withdraw opposition to the scheme.

Evesham.—PROGRESS OF SCHEME.—At a recent meeting of the Town Council it was reported that the electricity scheme was making progress. The cable extended as far as Abbots Morton and it was hoped to have a supply available for the town in October.

Federated Malay States.—ELECTRICITY SUPPLY PROGRESS.—*Eastern Engineering* states that the report of the chief engineer of the Federated Malay States Electricity Board (Mr. J. C. M. Matthews) for the year 1924 shows that the net profit on the Board's three main installations was $104,602. The Kuala Lumpur undertaking showed an increase in the sales of electrical energy of 255,787 kWh, the total sold being 2,495,235 kWh; the sales of the Ipoh undertaking were 671,235 kWh; and the energy sold by the Seremban undertaking amounted to 352,400 kWh. The Seremban installation was taken over from United Engineers, Ltd., at the commencement of the year. The plant at this station consists of five Ruston & Hornsby crude oil engines, driving Crompton d.c. generators, with a total capacity of 580 kW.

Grays Thurrock.—STREET LIGHTING.—The County of London Electric Supply Co., Ltd., is carrying out the street lighting of the district, and has placed an order with Messrs. Venner Time Switches, Ltd., for time switches in connection with the scheme.

Halifax.—INAUGURATION OF NEW PLANT.—An additional 10,000-kW turbo-generator was started by Ald. Sutcliffe, vice-chairman of the Electricity Committee, at the Corporation electricity works on September 3rd. The new set runs at a speed of 3,000 r.p.m., and has a maximum continuous output of 12,500 kW. The ceremony is dealt with in our "Notes" columns.

Hastings.—POWER STATION CLOSED.—The Corporation's electricity works at Earl Street was formally closed down by the Mayor on August 31st. All the energy required is now generated in the new Broomsgrove works.

India.—MANDI SCHEME.—According to *Indian Engineering*, the Administration Report of the Buildings and Roads Branch of the Public Works Department, Punjab, for 1923-24, states that Major R. N. Aylward investigated 150 sites for developing the water power resources of the Punjab and reported that about two million horse-power is capable of economic development. Of these sites the Mandi hydro-electric scheme is the first to be taken up, and carried out in stages. In the first

stage the River Uhl will be diverted and dropped 1,800 ft., creating 26,000 kW at a cost of under five crores. At the next stage by the addition of a dam another 44,000 kW will be secured at a cost of about one crore more. The third stage will give another 48,000 kW by the construction of a fall of 1,200 ft. Further developments will bring the total up to 177,000 kilowatts. It is calculated that the Uhl water power will suffice for the area from Saharanpur to Sialkot.

Electrical Development.—*Commerce Reports* states that the Municipal Council of the city of Vellore, Madras Presidency, which has a population of approximately 225,000, has been considering the installation of plant to furnish electricity for that city. The system of Madras has been studied. The report submitted would seem to show that the capital required for this scheme would be 440,000 rupees; that the municipality should have 1,400 lights for the streets, and that there would be 1,000 private consumers. No definite action has yet been taken.

Japan.—Kobe.—According to *Eastern Engineering*, the Municipal Electric Bureau recently started up a 12,500-kW set at Minatogawa as the second stage of the electricity extensions. The principal object of the extension is, however, to provide against a breakdown in the existing supply, and it is not intended to meet the yearly increasing demand in Kobe and Hyogo. Recently the head of the Bureau and the deputy mayor considered the necessity of increasing Kobe's present electricity supply to 50,000 kW, taking the local consumption for the next ten years into consideration. For this plan 18,000,000 yen is required. The floating of a public loan is projected.

Lytham-St. Annes.—Electricity Supply Progress.—The Town Council is applying for sanction to borrow £33,000 to carry out various works in connection with the electricity undertaking. The chairman of the Electricity Committee stated at a recent meeting of the Council that the increased demand for energy necessitated this step. During the year ended March, 1925, 3,352,000 kWh was sold, being an increase of half a million on the previous year, and nearly double the output of 1921. During the last four years the consumers had increased from 2,513 to over 7,000, and the requirements of 2,000 or 3,000 more consumers were being provided for. In addition, new mains were required from Squires Gate to Freckleton, a distance of nearly eight miles.

New Zealand.—Horowhenua Power Board.—According to the *Electrical Engineer of Australia and New Zealand*, the Horowhenua Power Board reports satisfactory progress during the year ended March 31st, 1925. The Board's reticulation consists of 105 miles of 11,000-V lines, 167 miles at 400 V, 50 miles for street lighting, and 36 miles of service lines. The supply to the boroughs of Otaki and Foxton is given through outdoor sub-stations. There are 61 sub-stations in operation, with a total capacity of 2,115 kVA. In all cases the transformation is from 11,000 to 400 V. The total number of consumers now connected to the board's lines is 1,583. Mr. T. R. Overton is engineer.

Peterborough.—Loan.—The Corporation Electricity Committee is applying for sanction to a loan of £1,950 for h.p. cables and switchgear.

Peterhead.—Electricity Supply.—At a meeting of the Town Council on August 31st, it was agreed to approve of a scheme submitted by the National Electric Supply Corporation to install plant for the provision of an electricity supply for the town.

Plymouth.—Loan Sanction.—The Electricity Committee has received sanction to a loan of £7,450 for converting plant.

Salford.—Electricity in Bulk.—The Electricity Committee has passed a resolution agreeing, in accordance with the recommendation of the South-East Lancashire Electricity Advisory Board, as a temporary arrangement, to provide Eccles Corporation with a bulk supply of electricity during the forthcoming winter.

South Africa.—Fort Beaufort (Cape Province).—The Municipal Council proposes to raise a loan of £8,000 for the provision of an electric lighting scheme.

Dorarecht (Cape Province).—The Corporation has decided to expend £6,500 on an electric lighting scheme.

Hope Town (Cape Province).—A ratepayers' meeting has adopted Mr. Val Davies's electric lighting scheme at a cost of £7,000.

Wynberg (near Cape Town).—The Municipality proposes to spend £9,000 on transformers and cables.

Special Orders.—Application has been made by the Electrical Distribution of Yorkshire, Ltd., for Special Orders authorising it to supply electricity in a number of urban and rural districts in the West Riding.

Application has been made to the Electricity Commissioners by the Urban District Council of Colwyn Bay and Colwyn to amend the Colwyn Bay and Colwyn Electricity (Extension) Order, by inserting provisions authorising the Council to charge certain maximum prices for electricity supply in the areas to be added under the Order.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them for the supply of electricity by the Lancashire Electric Power Co., in parts of the rural districts of Blackburn, Burnley, and Clitheroe.

Stretford.—Electricity Charges.—The Electricity Committee has decided that the scale of the basic tariff charges for power shall be amended, and that in lieu of a fixed charge of 25s. per h.p. of measured demand per quarter, the charge shall be 13s. 4d. per h.p., plus a running charge of .35 pence per kWh for energy as metered; also that the minimum consumption required under the scale shall be abolished.

New Plant.—The Committee is to purchase a 250-kW rotary converter, at an approximate cost of £1,700, for the purpose of giving an additional supply of electricity to Messrs. W. T. Glover & Co., Ltd.

Tarporley. — Scheme Approved. — The Urban District Council has given its consent to the application of Chester Corporation for a Special Order to supply electricity in the Council's area.

United States.—Electrical Development.—Contracts for the installation of a complete generating set for the new power plant of the Comal Power Co., a subsidiary of the San Antonio Public Service Co., at New Braunfield, Texas, have been awarded to the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pennsylvania. Included in the equipment is a 45,000-h.p. steam turbine and a 30,000-kW, 13,000-V generator. The plant, which will cost about $3,000,000, is expected to be completed within a year. It is designed to use powdered coal and will utilise the low-grade coal or lignite mined in the vicinity.—*Power*.

Installation of the second 30,000-kW unit of the new 200,000-kW power station of the Metropolitan Edison Co. on the Susquehanna River at Middletown, Pa., was recently commenced. The first set was placed in operation early this year, and the second is expected to be ready for service in March, 1926.—*Electrical World*.

Wakefield.—Loan Sanctioned.—The Town Council has received sanction to a loan of £15,000 for mains and services.

Wirral.—Electricity Supply.—The Electricity Committee of the Rural District Council, after considering the offer of the Birkenhead Electricity Committee to supply the whole of the parishes in Wirral with electricity at a cost of 6¼d. per kWh (inclusive of the distribution charges, cables, &c.), has declined the offer and has decided to proceed with its own scheme at a cost of £180,000. Under this arrangement, the Wirral authority will obtain bulk supplies from Wallasey Corporation and the Mersey Power Co., Ltd., Ellesmere Port.

Tramway and Railway Notes.

Aberdeen.—Year's Working.—The report on the working of the Corporation tramway undertaking (general manager: Mr. W. Forbes) for the year ended May 31st last shows a total income of £189,247, as compared with £181,985 in 1923-24. Working expenses increased from £142,808 to £150,691, and there was a gross profit of £38,556 (£39,177), to which was added interest on investments of £5,290, making a total of £43,846. Capital charges absorbed £43,407, leaving a net surplus of £438 as compared with £2,875 in the preceding year. The capital expenditure during the year amounted to £30,247, of which £14,754 was spent on permanent way. The number of passengers carried increased by 1,930,554 to 43,201,580, and the car-miles run from 2,436,794 to 2,675,785. The extension of the Queen's Road route to Hazlehead was completed during the year. The fiftieth anniversary of the undertaking was celebrated on September 1st, 1924.

Blackpool.—Tramway Improvements.—The Corporation will shortly commence a road improvement scheme in connection with its Fleetwood tramway route. In Lord Street and North Albert Street, Fleetwood, the pillars carrying the overhead wires for the tramway are to be moved from the centre of the roadway to the side, and, in addition, the two sets of lines, which are now 10 ft. apart, are to be moved closer together.

Burnley.—Year's Working.—The report on the working of the Corporation tramway undertaking (general manager: Mr. H. Mozley) for the year ended March 31st last shows a total revenue of £165,620, as compared with £159,893 in the preceding year. Working expenses increased from £125,113 to £130,800, leaving a gross profit of £34,819 (£36,780). After deducting capital charges, and a loss on the motor-omnibus system of £165, there was a net surplus of £12,352, which was transferred to the relaying and renewals account. The previous year's working resulted in a surplus of £15,065. The number of passengers carried increased from 21,758,743 to 23,550,878, and the car-miles run from 1,789,406 to 1,902,058.

Continental.—Germany.—A proposal that the railways in Wurtemburg should be electrified at the same time as those in Baden and Bavaria has been submitted to the Reichstag.

Italy.—The Società dei Tramvie Elettriche Provincia di Imperia has secured a concession for the construction of an electric tramway in the town of Imperia. The steam tramway between Caldiero and Tregnano is also to be converted to electric traction.

Japan.—New Tramways.—A petition has been presented to the Hyogo Prefectural Office by Mr. K. Morimoto, of Osaka, and others for permission to lay a tramway between Koshiki, on the Hankyu line, and Uchide, *via* Kurakuen. The line would cover a distance of 2.8 miles, and the promoters intend to start a company with an authorised capital of y. 500,000. A tramway between Kurakuen and Kurakuen-guchi has already been sanctioned by the Kencho.—*Eastern Engineering*.

Leeds.—REDUCTION OF FARES.—The City Council has decided to reduce the tramway fares from 2½d. to 2d. and 4d. to 3d., and so on *pro rata*, with a maximum through fare between the city and any terminus (except Morley) of 3d. It is estimated that the reductions are equivalent to a loss of revenue of approximately £50,000 per annum.

London.—PICCADILLY STATION PROGRESS.—Good progress is being made with the construction of the new tube station at Piccadilly Circus. On the site where "Eros" stood, a working shaft has been driven down to a depth of 26 ft., and from the bottom of this, the narrow "pilot tunnel" of the main escalator shaft is already bored to a further depth of 42 ft. This shaft will house three moving stairways abreast. At the lower end of it a landing is now being constructed, and from this point two pairs of escalators will connect with the Bakerloo and Piccadilly lines. An area of 15,000 sq. ft. will be devoted to the booking hall. The reconstruction of this station is one of the biggest schemes included in the Underground company's programme of new works. The work is not expected to be complete before the end of 1926, but then the new station will be able to handle 50,000,000 passengers annually.

ONE-MAN TRAMCARS.—The Hanwell to Brentford route of the London United Tramways is now entirely operated by tramcars of the one-man type, and the service has been increased by 50 per cent. One of the principal features of interest of the new cars is the automatic doors which, being interlocked with the "steps," cause the latter to fall into position when the car stops and fold up again before the car re-starts. The driver is unable to start until the doors are closed, and it is also impossible for passengers to open the doors whilst the car is in motion.

Worcester.—RAILLESS CARS.—A recommendation has been made to the City Council in favour of giving authority to the Streets Committee to apply for Parliamentary powers to work the tramway, to convert it to the railless-car system, and to provide a fleet of omnibuses in the city and outside on routes approved by the Ministry. A report has been prepared by Mr. Alfred Baker, manager of Birmingham Corporation tramways.

Telegraph and Telephone Notes.

China.—RADIO DEVELOPMENT.—The Japanese Foreign Office states that the Peking Government has approached Mr. Yoshizawa, the Japanese Minister in Peking, regarding the settlement of the radio question. China, it appears, proposes the raising of a joint Japanese-American loan for the purpose of constructing a Chinese radio system in conjunction with the existing Japanese system. Owing, however, to the vagueness of the Chinese suggestions, Japan does not intend to take any action until further details are received from Peking.—*Reuter* (Tokio).

Germany.—CABLE LOADING.—Herr Wagner, the president of the Telegraph Institute of Berlin, in the course of a recent address on "Trans-Oceanic Telegraphy," referred to the Western Electric Co.'s method of overcoming the effect of capacity by a self-induction device, surrounding the whole length of a cable with a thin band of "permalloy." He said that the technical laboratory of the German Telegraphs, in collaboration with a number of electrical concerns, had produced an alloy containing only 40 per cent. nickel which could be used in substitution for "permalloy." This new alloy is, states *Electrotechnik und Maschinenbau*, being used in the German-American cable which is being laid by the German Transatlantic Cable Co.

International Telegraph Conference.—PARIS MEETING.—The International Telegraphic Conference, briefly referred to last week, was formally opened at the Sorbonne in Paris on September 1st. The French Minister for Commerce and Posts, M. Chaumet, welcomed the delegates and the commercial delegate for Portugal, where the last conference was held, replied. The leading French delegate, M. Daletete, then took the chair and the conference split itself into four committees to deal with the different subjects on the agenda, the most important of which are an increase in tariffs and code messages. As regards the latter, there are various motions on the agenda for changing the existing classifications into clear "code" and cipher; at present pronounceable non-dictionary words are classed as "code" and must not exceed ten letters, while unpronounceable words (including figures) are "cipher" and must not exceed five letters. One proposal is to class all words in letters, whether pronounceable or not, as "groups" to be treated as code and to limit cipher to figures. Another suggestion is equivalent to the abolition of "code" and the classification of all non-dictionary words as "cipher." The former course would result in a reduction of cost, while the latter would have an inverse effect. It is understood that the British and Dominions delegations are opposed to the principle of an increase of tariffs in any form, and it is expected that there will be a big fight on this matter. Another question is the priority of telegrams; at present no priority is allowed for what may be called "life and death telegrams" affecting the safety of persons, and it is proposed to award priority in this connection. International telephone rates and the relations between wireless and cables are also on the agenda. French is the only language which may be used at the Conference and no interpreters will be allowed; this will handicap delegates who are not fluent French speakers. It has been decided that cable companies and countries which are not members of the Telegraphic Union shall have a deliberating voice in the Committees, but no voting power; the Committee work is likely to occupy the Conference until next month. No decision has so far been reached as regards Press communications.—*Reuter* (Paris).

Italy.—NEW TELEPHONE CABLE.—A new telephone trunk line has recently been completed between Naples and Catanzaro, a distance of approximately 190 miles. New international lines have also lately been inaugurated between Milan and Geneva and between Milan and Berne. Of the latter line about 100 miles is in Italian territory, and part (nearly three miles) is laid in the bed of Lake Maggiori.

Madagascar.—Two radio-telegraph stations have recently been established by the French Colonial authorities—one at Bamako in French Africa and one at Tananarivo, Madagascar. The plant at the Bamako station, which has a capacity of 100 kW, comprises two Bethenod-Latour high-frequency alternators which are operated alternately. Messages can also be sent out by means of spark emitters, this being intended to meet the requirements of navigation and explorers. The necessary power is supplied by two Diesel engines and two steam engines. The power plant, which is adapted to use wood as fuel, is also being utilised to supply the town of Bamako with electricity for lighting purposes until this can be taken over by the hydro-electric station which is being established on the Niger. The plant at Tananarivo is similar to that at Bamako, except that it has a capacity of 150 kW, the distance from Paris being about 5,000 miles.

South America.—TELEGRAPH CONCESSION.—Following the arrival of Señor Francisco Becerra, a representative of the Marconi Company from Argentina, a fortnight ago, *The Times* Lima correspondent announces that the company has in mind the initiation of a series of improvements and extensions of the existing Peruvian postal, telegraph, and wireless services. The scheme, which involves an expenditure of approximately £500,000, includes the erection of a powerful beam station linking up Lima, Buenos Aires, Bogotá, Rio de Janeiro, and the United States. A proposed 25-year concession to the company is under discussion by Congress, and it is thought that the necessary approval will soon be given.

United States.—AIRCRAFT TELEPHONY.—Successful two-way radio telephone communication between aeroplanes and the ground was established in the anti-aircraft test manœuvres just concluded at Fort Tilden, a device having been perfected at the radio laboratories of the signal corps at Camp Vail, New Jersey. A helmet is worn by the aviator, cutting off the noise of the aero-engine and the difficulties caused by the engine's spark system, which had previously prevented successful attempts at communication. The aviators using the radio telephone could hear the land station from a distance of eighty miles, while the airman could talk with the station from a distance of thirty miles.—*Reuter* (New York).

Radio Notes.

Aerials.—CONTROL BY PUBLIC AUTHORITIES.—On Tuesday last the Public Health Act, 1925, came into operation. Section 26 of this Act empowers local authorities to make by-laws for the prevention of danger or obstruction in streets or public places by aerials used in connection with radio-telephony and telegraphy.

Interference Elimination.—WAVELENGTH TESTS.—British and European broadcasting stations are continuing their night tests of the efficiency of the newly-allotted wavelengths as a means of preventing interference between stations. So far as Great Britain is concerned, results are regarded as satisfactory notwithstanding the fact that some disturbance was experienced from unexpected sources. Equilibrium will doubtless be established by the time the test transmissions have ended, but wavelengths will probably have to be modified still further before an amicable understanding is arrived at. It is to be noted that the new wavelengths are not based on length, but on frequency, thus introducing fractions of a metre. The last test transmission will take place on Monday night, September 14th.

Radio Exhibition.—Last year's radio exhibition in Berlin showed the restrictions of the German postal authorities to have been somewhat severe. Government regulations were modified on September 1st, 1925, however, so as to permit the production of apparatus that will receive on any wavelength up to 3,000 metres, and the change was made known to manufacturers in time to allow them to prepare entirely new apparatus for the show which is being held in Berlin from September 4th to 13th. The granting of amateur transmitting licences is also under consideration.

United States.—AMATEURS' CONVENTION.—The third International Convention of the American Radio Relay League was held at Chicago, concluding on August 21st, and aroused much enthusiasm, the subjects dealt with by prominent radio authorities covering a usefully wide range. A plea was made for more attention to be given to the use of efficient transmitters, in order to reduce the power expended. Mr. J. C. Warner, of the American G.E.C., announced the completion of work that will assist the standardisation of valve bases and sockets.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—November 9th. Electricity Commission of Victoria. 6,600-V and l.p. lead-covered and armoured cable. 22,000-V, 3-core cable and accessories. (September 4th.)

P.M.G.'s Department. October 27th. Telephone transmitters and parts.*

November 10th. Telephone receivers and parts.

November 17th. Magneto-automatic junction material.*

Birkenhead.—September 17th. Mersey Railway Co. Stores, *viz.* :—Electrical sundries, &c., and metallic and carbon-filament lamps and fittings. Form of tender from Mr. J. Shaw, general manager and secretary, Central Station, Birkenhead.

Brentford.—September 22nd. Board of Guardians. Electric wiring, &c., at the Institution, Warkworth House, Isleworth. (September 4th.)

Croydon.—September 14th. Board of Guardians. Six months' supplies of electrical fittings and accessories. Mr. N. P. Walker, clerk to the Guardians, Mayday Road, Thornton Heath.

Dundee.—Town Council. Electric lighting work at Strathmore Avenue housing scheme. Particulars from Mr. Geo. Baxter, city engineer.

Gainsborough.—October 17th. Urban District Council. Generating plant, mains, transformers, and meters. (September 4th.)

Halifax.—September 15th. Board of Guardians. Electrical fittings (excluding electric lamps) required at several institutions during the six months ending March 31st, 1926. Form of tender from Mr. A. T. Longbottom, clerk to Board of Guardians, Union Offices, Carlton Street.

India.—India Store Department. September 15th. Accumulator and alkaline cells. (September 4th.)

Lanark.—Education Authority. Electric lighting work at school extension at Whifflet. Mr. John Stewart, master of works, 20, Albert Street, Motherwell.

London.—H.M. OFFICE OF WORKS.—September 15th. Supply of electrical and mechanical engineering labour-in-daywork in Cardiff. (August 28th.)

September 24th. Electric wiring installation at the White Wing, British Museum. (September 4th.)

METROPOLITAN ASYLUMS BOARD.—October 7th. Installation of a fire-alarm system at Tooting Bec Hospital. (September 4th.)

ISLINGTON.—September 17th. St. Mary's Board of Guardians. Electrical supplies for six months. Mr. A. King, clerk, St. John's Road, N.19.

SOUTHWARK.—September 23rd. Electricity Department. Twelve months' supply of electric cables. (See this issue.)

HAMMERSMITH.—September 23rd. Electricity Department. Construction of an underground water-tight ferro-concrete pump chamber and overhead pump house at Chancellor's Wharf, also supply of coal for the electricity works. Specifications from the borough electrical engineer.

New Zealand.—CHRISTCHURCH.—January 5th, 1926. Drainage Board. Three electric sewage pumps. (AX. 2349.)*

Northampton.—The Corporation is inviting tenders for new electric lighting arrangements at the Town Hall.

South Africa.—JOHANNESBURG.—S.A. Railways. October 15th. Incandescent lamps.*

Warrington.—September 12th. Electricity and Tramways Committee. E.h.p. and l.p. paper and lead covered cables. (See this issue.)

September 22nd. Board of Guardians. Six months' electrical supplies for the Whitecross Institution, Warrington, and the cottage homes, Padgate. Particulars from the clerk.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Battery Contracts.—The Edison Swan Electric Co., Ltd., has received contracts for inert cells from the Air Ministry, and for inert batteries from the Admiralty; for dry cells from the Metropolitan Railway Co.; and for dry batteries from the Irish Free State Army.

Bournemouth.—Bournemouth Corporation last week unanimously decided to accept an English tender for 600 tons of steel rails for tramway reconstruction, at a cost of £1,200 more than a Belgian's firm's offer. It was stated that five tenders—three English, one German, and one Belgian—had been received.

Burton-on-Trent.—Electricity Committee. Accepted:—

Two 250-kVA transformers (£478).—Metropolitan-Vickers Electrical Co., Ltd.

Extension of electricity main to Barton (£7,162).—Johnson & Phillips, Ltd.

Darlington.—Electricity Committee. Accepted:—

6,000-kW turbo-alternator (£21,021).—Fraser & Chalmers Engineering Works.

Two boilers (£19,890).—Babcock & Wilcox, Ltd.

Derby.—Corporation. Accepted:—

Erection of patent automatic floatswitch, sewage-lifting plant with automatic electrically-driven air-compressing plant, with duplicate sets of electrically-driven storm-water pumping sets, fitted with automatic control gear, for the Cowsley housing estate.—Daniel Adamson & Co., Ltd.

Dundee.—Housing Committee. Recommended:—

Electrical work at new houses:—Stirling Park: D. J. Macdonald, Ltd. (£200); Lawton: Hutton & Co. (£1,752).

Farnborough.—Air Ministry. Accepted:—

2,100-amp.-hr. battery, with charging apparatus.—Alton Battery Co., Ltd.

Fleetwood. Accepted:—

Installing electric lighting in semi-detached houses in Agnew Road.—W. Roskell and E. Swarbrick.

India.—India Store Department.

Spares for 750-b.h.p. Diesel oil engine (Rs. 18,590), English Electric Co., Ltd.; 25 a.c. ceiling fans (Rs. 2,938).—General Electric Co. (India), Ltd.—*Indian Engineering.*

Lamp Contracts.—The Admiralty has placed a contract for 99,100 "Osram" vacuum lamps, 3,161 "Osram" gas-filled lamps and 150,700 "Robertson" filament lamps with the General Electric Co., Ltd. The Southern Railway has accepted a tender for a six months' supply of "Mazda" lamps from the British Thomson-Houston Co., Ltd.; and for a six months' supply of "Osram" metal-filament vacuum and gas-filled lamps and "Robertson" carbon-filament lamps from the General Electric Co., Ltd.; it has also placed a six months' contract for vacuum and gas-filled-type lamps with the Siemens and English Electric Lamp Co., Ltd.

London.—METROPOLITAN ASYLUMS BOARD.—Institution Committee. Recommended:—

Alterations and extensions to electric lighting at North-Eastern Hospital:—

Alpha Manufacturing & Electrical Co., Ltd. (Recommended.)	**£465**
Smethurst & Co. (London), Ltd.	521
Riddle & Goddard, Ltd.	537
Toy & Winslow	585
A. Hawkins & Sons	630
T. Clarke & Co., Ltd.	636
L. J. Godfrey	639
Berry Bros.	650
Coley & Swinnerton, Ltd.	723
H. R. Hall & Co.	804
North Metropolitan Electric Power Supply Co.	812
M. Greenwood & Son, Ltd.	821
Best & Wilson	880

Overhauling electric light engines at St. Luke's Hospital (£346).—J. Downton & Co.

Manchester.—Sewers Committee. Accepted:—

Two 25-b.h.p. motors, &c., for Withington works.—Lancashire Dynamo and Motor Co., Ltd.

Tramways Committee. Accepted:—

Steel girder rails and fishplates.—Cargo Fleet Iron Co., Ltd.

Steel clip plates—R. White & Sons.

Newport (Mon.).—Great Western Railway Co.

Five electric capstans at South Quay.—Stothert & Pitt, Ltd.

South Africa.—DURBAN.—Corporation. Accepted:—

Two 100-kVA 3-phase transformers (£207); two 50-kVA ditto, ditto (£129); three e.h.p. switch cubicles for Hewitt Road sub-station (£317); three tons 19/14 bare copper wire (£266).—T. Barlow & Sons, Ltd.

Eight 250-kVA transformers (£1,376).—Bartle & Co., Ltd.

Two tons No. 10 S.W.G. bare copper wire (£163); two tons No. 8 ditto (£163).—W. T. Henley's (S.A.) Telegraph Works Co., Ltd.

One 500-kW automatic rotary converter equipment (£4,030); fifteen 100-kVA single-phase transformers (£1,207); e.h.p. and h.p. switchgear for Mitchell Park and Evans Road sub-stations (£2,525).—Metropolitan-Vickers Electrical Co., Ltd.—*South African Power Engineer.*

JOHANNESBURG.—Contracts approximating £25,000 have been placed by the Electricity Supply Commission of South Africa for a hydro-electric station at Sabie, Eastern Transvaal:—

Pipe line and accessories and transmission lines.—Dowson & Dobson.

Pelton wheels, generators, crane and lighting set.—Reunert & Lenz.

Transformers and accessories; switchgear, cables, and telephones; lighting installation and test instruments.—Siemens Bros. & Co., Ltd.

Workshop equipment.—British General Electric Co., Ltd.

—*South African Mining and Engineering Journal.*

Singapore.—Municipal Commissioners. Accepted:—

Patent automatic floatswitch sewage-lifting plant, comprising pneumatic sewage ejectors in c.i. tubing, operated by electrically-driven air compressing plant automatically controlled, at junction of Jalan Sultan and Northbridge Road.—Daniel Adamson & Co., Ltd.

Forthcoming Events.

Industrial Welfare Society.—September 11th to 16th. Annual Lecture Conference. At Balliol College, Oxford.

N.A.R.M.A.T. Wireless Exhibition.—Royal Albert Hall, S.W. September 12th-23rd.

Institution of the Rubber Industry.—Monday, September 14th. At the Engineers' Club, Coventry Street, W. At 8 p.m. Paper on "Some Rubber Compounding Tendencies," by Mr. W. B. Wiegand.

Institution of Public Lighting Engineers.—September 14th-16th. At Leeds. Annual meeting and conference.

Notes.

Gas-Men and the "Menace of Electrical Advancement."—Our readers will be interested in the following copy of a "Private and Confidential" communication which was addressed to members of the Society of British Gas Industries by the Chairman of the Council under date August 25th, 1925:—

Dear Sirs,

Our members on the Executive Committee of the British Commercial Gas Association were summoned to an emergency meeting at the offices of the Association on July 29th. I attended and Mr. Tilley also was present at a full meeting of the Executive.

The object of the meeting was to impress upon the members the urgent necessity of a special publicity campaign to be carried out in October, to counteract the activities of the British Electrical Manufacturers' Association who are proposing to run a very intensive publicity campaign in the autumn, with a view to gaining public favour to the Government scheme for subsidising and development of electrical power stations, and the industry generally.

It was suggested that an appeal should be issued to all gas undertakings for a special subscription of 2s. per million to cover the cost of the campaign, which is estimated at about £25,000. Although the B.C.G.A. have not made any special appeal to the Society for financial support they have intimated that any help and co-operation we can give will be very much appreciated.

I will not labour you in this letter with details of the expenditure suggested, or the outline suggestions which were placed before us. Briefly, however, they include:—

1. Special advertising campaign during October.
2. An essay competition.
3. Special gas week throughout the country.
4. A national function at Wembley on a large scale.

The details of the whole scheme are most excellent in every way and very comprehensive. A copy of the complete scheme may be seen at these offices by those who are interested.

The scheme was unanimously approved by the General Committee of the B.C.G.A. at the meeting in the afternoon, and an appeal is being sent out to the industry.

In view of the urgency of this matter, I called a special meeting of our Council on the 13th inst. to lay this proposal before them, at which meeting it was decided to send out an appeal to our members, and I therefore do not hesitate to ask for your assistance.

The menace of electrical advancement through what we consider unfair channels is a very live one, and we cannot allow the activities of our rivals to proceed without vigorously combating the same. This is an opportunity for our Society to show that it is alive to the situation and I therefore beg your generous support, which I shall greatly appreciate.

Would you be good enough to intimate to our secretary the amount of your subscription, which should be received before the middle of September.

Believe me, yours faithfully,
B. B. WALLER,
Chairman of the Council.

Electricity v. Gas.—There were frequent references to the competition of electricity with gas at the annual meeting of the Gas Managers' Association of Scotland held at Dunfermline last week. Mr. James Campbell, gas manager, Dunfermline, in his presidential address, said it was being urged that cheap electrical power would be a cure for the evil of unemployment; and yet on the north-east coast of England, where there were the largest super-stations in this country, belonging to an electricity undertaking probably as up-to-date and efficient as any in the world, and supplying current over a large area at very low rates, the depression of industry was as great as, if not greater than, in any other part of the country. The opposition of the gas industry to the proposed subsidising of its rival was in no sense in the spirit of "the dog in the manger," but was conceived entirely from the view that the granting of subsidies to industry was wrong in principle—especially when, as in this case, one industry would be helped at the expense of another in practically the same line of business. That the electrical industry was in no need of help was shown by the dividends paid by the leading companies. All they asked was that each industry should have a fair field, and no favour, and be allowed to work out its development along lines to be decided by its administrators.

Chill Cast Aluminium.—A method of producing chill-cast aluminium articles with a high degree of tensile strength and density is, according to *Aluminium*, being developed by a German firm. It is claimed that these castings can be produced to limits of about ± 0.01 in., and that even in thin walls down to about 0.04 in. in thickness, the full density and tensile strength of the remainder of the casting can be maintained.

Italian Electrical Congress.—The Associazione Nazionale Industrie Elettriche is holding its first congress in Milan on October 2nd, 3rd, and 4th. Among the papers to be read at the meetings are one on "Tariffs, Prices and Payments for Electrical Energy," by Sig. Giacinto Motta, and one on "The Incidence of Electric Power Costs on Industrial Production," by Sig. Renzo Norsi. Visits are to be paid to the Adda power station at Paderno of the Società Edison and the hydro-electric station in course of construction at Chiavenna for the Società Cisalpina.

Remagnetising Magnetos. — A correspondent asks if any reader will furnish particulars of the best apparatus for remagnetising magnetos, saying if a large current is necessary, and of the best method and apparatus for magnetising 'phones.

Educational.—LONDON COUNTY COUNCIL SCHOOL OF ENGINEERING AND NAVIGATION, High Street, Poplar, E.14.—Major and minor courses in electrical engineering (session 1925-6) will commence on September 28th (enrolment during week commencing September 21st). Prospectuses and full particulars can be obtained on application to the secretary at the school. (See our advertisement pages to-day.)

We have received the calendar of the Royal Technical College of Glasgow for the 1925-26 session. The electrical engineering department provides preparation courses for the B.Sc. engineering degree and the College Diploma. Evening-class courses are also provided in electrical engineering for students who have already attended satisfactorily a course of electricity and magnetism.

The 1925-26 session of the College of Technology, Manchester, begins on October 8th. Included in the prospectus are university courses and part-time day and evening courses in electrical engineering and allied subjects. The electrical engineering syllabus covers an extensive field of study, and the college is equipped with up-to-date electrical laboratories.

THE POLYTECHNIC. — Special courses in wireless and high-frequency engineering have been arranged for the coming session at the Polytechnic, Regent Street, London, by the electrical engineering department. The courses extend over three years and cover the technique of radio communication and testing. A licence has been obtained, and instruction will be given in the operation of a valve transmitter. Students may enrol on September 16th and onwards between 6 and 8.30 p.m. Mr. Philip Kemp, M.Sc., M.I.E.E., is head of the department, and Capt. W. H. Date, B.Sc., A.M.I.E.E., is head of the wireless section.

B.E.S.A. Specification. — The British Engineering Standards Association has issued a British standard schedule of steel for die blocks for drop forging. This schedule, which has been drawn up in co-operation with the Association of Drop Forgers and Stampers, the Alloy Steelmakers' Association, and the National Federation of Iron and Steel Manufacturers, contains specifications for four classes of steel for the die blocks, covering chemical composition, heat treatment and mechanical tests. Copies of this publication may be obtained from the B.E.S.A. Publication Department, 28, Victoria Street, London, S.W.1, price 1s. 2d. post free.

Fatalities.—On September 3rd, a gas-holder at the Rugby works of the British Thomson-Houston Co., Ltd., containing gas for use in the manufacture of incandescent lamps, exploded, causing the death of one man and injuries to three others. A number of workpeople had remarkable escapes from being injured by large pieces of metal hurled for long distances by the explosion.

Electroculture.—An increased yield of 51 per cent. has been obtained in experiments in growing potatoes with the help of electricity at Stubbington, a village near Portsmouth.

The tests were carried out by the schoolmaster, Mr. R. A. Rushforth, with apparatus of his own invention, on a piece of ground tilled by the scholars.

The *Daily Mail* states that when the potatoes which had been grown with and without electricity were dug up the yield was as follows:—

Variety.	Average yield per set. With electricity. lb.	Without. lb.	Per cent. increase.
King Edward	2.44	1.8	35.3
Sharp's Express ...	2. 0	1.2	66.6
		Net increase per cent.	51.0

The apparatus cost about 24s. and could be made by any handyman. The cost of the electricity was 7d. for the season. Mr. Rushforth is confident that the same apparatus would do for a field as well as for a small plot, the additional wire being the only extra requisite.

The potatoes electrically grown were not affected by the usual pests.

Artificial Crop-drying.—The following note appears in *The Implement and Machinery Review* for September 1st:—"The bad weather has done a good turn to the advocates of artificial crop-drying. . . . In one instance a farmer with 1,000 acres under arable, told us that he had 100 acres of corn and did not know what to do with it owing to the rain. On our advice he got in touch with the advocates of artificial crop-drying, and one day during the very unsettled spell of wet weather which marked the earlier and middle days of August, he told us that he had just dried out satisfactorily three stacks of barley and was that day turning his attention to a large stack of oats. What he would have done with the crops under the circumstances had he been denied the assistance of the artificial drier, he did not care to contemplate. Certainly until he got in touch with the makers of the plant he was in a predicament, but he had since found that the artificial drier worked fully up to expectations and had been a means of saving his crops in the wet weather. As many people have decried the artificial method of handling crops as not worth the trouble, we give the foregoing testimony for what it is worth, with the addendum that it comes from a reliable source, the farmer in question being a resourceful man farming on a large scale and employing modern implements and machinery, including steam tackle and tractors, to the full."

Electrical Dishwashers in the States.—Suddenly—almost overnight it would seem—the electric refrigerator has caught the fancy of the American public, and sales of this device are now taxing the capacity of the makers. The electric ice-box holds the imagination of the public as being a near-magic substitute for an at-best troublesome item of household equipment. But in the electric-appliance family there is another Cinderella, also destined to blossom forth at the touch of that belated prince, Popular Interest. This is the electric dishwasher, a device certainly due soon to come into its own in public favour. For the dishwasher is the one electric appliance yet little known or accepted by the public, which has an inherent strong "interest appeal" an appeal as fundamental as its own solution of the problem of 15 hours' home drudgery a week. Properly promoted before the public, the idea of "washing dishes by electricity" possesses certain of the spectacular elements of electric refrigeration and even radio—in ability to stimulate popular interest and to bring new faces into the electric shop. Several dealers we know of are building their full publicity plans about the dishwasher as the magic wand to whisk away the housewife's troubles. These merchants are putting advertising appropriations into this device as a "leader" and as a novelty which will create fresh interest in their general appliance lines—besides selling dishwashers also. Their lead in thus dramatising the dishwasher is one which electrical merchants generally should not overlook. For electrical shops everywhere can well utilise the appeal of this useful appliance as a re-creator of popular interest in the whole electrical idea.—*Electrical Merchandising.*

Appointments Vacant.—Sales engineer (£300) for the Doncaster Corporation electricity department; charge engineer for the Gravesend Corporation electricity works; shift engineer for Swindon Corporation electricity department; two plumber-jointers for the St. Helens Corporation electricity department; power station superintendent for the City of Port Elizabeth electricity undertaking; generating works superintendent (£569), for the Croydon Corporation electricity department. (See our advertisement pages to-day.)

Electric Taxicab Possibilities.—Under this title the *Commercial Motor* suggests the revival of the use of battery passenger cabs in London, considering that the improvements which have been made in the past few years have made this type of vehicle very reliable and satisfactory. Our contemporary says that one of the leading qualifications of the electric vehicle is its rapidity in traffic. This is due both to a high rate of acceleration and the extreme ease of control, and in these respects it cannot be rivalled by the ordinary petrol vehicle. There would, therefore, appear to be a very good case for the electric taxicab, particularly as its smooth running, silence, cleanliness and freedom from smell should appeal to a large class of user. The ordinary taxicab requires a trained staff for its upkeep, but the maintenance of the battery electric taxicab is one of the simplest of tasks. Occasional lubrication at only a few points and cleaning are the main items, the charging, of course, being in the hands of the officials at the power stations. Charging would take place late at night or very early in the morning, when there would be no peak loads, and operating on smooth roads with comparatively few hills (conditions which occur particularly in the Central London area), the mileage per charge should be considerable. The difficulty which was experienced years ago in securing an efficient staff for the maintenance of batteries no longer exists, while there is much fuller knowledge on the whole subject, so that the undue cost incurred under this head is a thing of the past.

New Plant at Halifax.—On the afternoon of September 3rd a new 10,000-kW turbo-alternator at the Halifax Corporation's electric power station at Foundry Street, was started officially by Alderman Sutcliffe, vice-chairman of the Corporation Electricity Committee, and Mrs. Sutcliffe. The machine was supplied by the British Thomson-Houston Co., Ltd., and runs at 3,000 r.p.m. Many visitors were present at the ceremony, including Mr. J. P. Gregory, of the British Thomson-Houston Co., Ltd., who presented Mrs. Sutcliffe with a gold wrist watch. Accompanying Mr. Gregory was Mr. J. Reid, representing Messrs. Worthington-Simpson, Ltd., builders of the condensing plant. Thanks to the "starters" were expressed by Councillors Crabtree and Barrett, who remarked that the Committee had studied very closely the different types of plant to be installed, including 30,000-kW equipment, but had realised what a vast amount of machinery would be standing in the event of such plant getting out of order, and they believed they had selected the "top line" of plant for Halifax or any other town. Alderman Sutcliffe, responding, said he fancied that if progress in the department continued on present lines they would soon have to consider a new station. The party was subsequently conducted over the works, and tea was served later at the White Swan Hotel, under the chairmanship of Alderman Hey, chairman of the Electricity Committee. Alderman Longbottom, proposing the toast of the Tramways and Electricity Committee and the chairman and vice-chairman, said the present outstanding capital on the undertaking was £466,614, and the day was not far distant when they would have to consider whether or not they were on right lines in taking money from the department for relief of rates rather than using it in quicker liquidation of capital. They were all delighted with the new scheme for linking up electricity supply between Halifax and Huddersfield, to the mutual benefit of both towns. The day had come when municipalities must set aside parochial feelings, and he welcomed the scheme. Alderman Hey replied, and Alderman Sutcliffe paid tribute to Mr. Rogerson, the borough electrical engineer, and his staff, and said that without co-operation between the chief and his staff the department could not have progressed as it had done. The Mayor proposed a toast to the contractors, and complimented them on the results of their work. Mr. J. P. Gregory, responding, said the initiative shown at Halifax was evidence that Mr. Rogerson was not only a sound practical engineer, but also a man of commercial ability—proof of which was particularly found in the showroom of the department. In reply to a toast, Mr. Rogerson said he did not think there was a nut or a split pin in the works that had been in when he came 24 years ago. The work throughout had been very enjoyable, more particularly as he had had in Alderman Hey a chairman who was keenly interested in the department, and realised his own personal responsibility.

United States Electrical Manufacturing Plant.—In tables published in the *Electrical World*, taken from the United States census of manufacturers, 1923, particulars are given concerning the numbers, types, and h.p. of the prime movers in use in the electrical manufacturing industry; and also of the coal consumed and the cost of materials, &c. The total number of prime movers in use in 1923 is shown as 52,410, representing 480,268 h.p., against 17,572 machines totalling 226,320 h.p. in 1914. In this total are included 249 steam engines and turbines, 60 internal-combustion engines, 25 water turbines, and 52,076 electric motors (totalling 297,838 h.p.), driven by purchased energy. The number of electric motors driven by energy generated on the establishments is shown as 43,575, aggregating 233,419 h.p. In 1914 the total h.p. of electric motors installed was 262,119, representing 39,568 machines. The amount of coal consumed in the industry during 1923 is shown as 1,417,929 tons, compared with 844,122 tons for 1914. The cost of materials for 1923 is recorded at $548,626,673, against $154,728,076 for 1914. The value of the products is shown as $1,293,001,771 for 1923, as compared with $335,170,194 for 1914.

The Institution of Structural Engineers.—The Council of the Institution has decided that from January 1st next admission to membership of the Institution will be gained by examination only. In the meantime a final opportunity is to be given to those who have some years of practical experience in the profession and who wish to make application for direct admission.

Thermo-Electric Generator.—Experiments are proceeding at Sheffield University with a view to testing the possibility of a new means of generating electricity. According to the *Daily Mail*, Dr. T. F. Wall, head of the Electrical Engineering Department of the University, claims to have obtained, by means of a new process, a form of thermo junction capable of developing about 0.05 volt per junction when heated to the requisite temperature.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

On leaving Croydon to take up his duties as borough electrical engineer at West Hartlepool, Mr. J. H. PARKER was presented by the staff and employés of the Croydon Corporation Electricity Works with a gold watch and fitted suit-case. In making the presentation, Mr. A. C. Cramb, engineer and manager of Croydon Electricity Department, referred to the valuable services Mr. Parker had rendered to the undertaking, and wished him every success in his new position.

The Times reports that Mr. C. J. MCKENZIE, assistant engineer-in-chief of the New Zealand Public Works Department, who is now visiting London, spent five months in Canada and the United States inspecting highways, railroads, marine, hydro-electric, and irrigation works, and will pursue similar investigations in Great Britain and afterwards in France and Italy.

The marriage took place, on September 1st, of Mr. H. W. TOMPKINS, assistant engineer at the Grays Electricity Works, and Miss N. R. HILLS.

Mr. E. E. SMEETON has been appointed power station superintendent in the Cheltenham Corporation electricity department.

Mr. A. B. BLAKEY, A.M.I.E.E. (manager of the Birmingham office of the Lancashire Dynamo & Motor Co., Ltd., and of the Crypto Electrical Co., Ltd., for 18 years), who has recovered from his illness, has started in business on his own account at 4, Valentine Road, King's Heath, Birmingham.

Mr. W. R. MONTGOMERY, A.M.I.E.E., has resigned his position as resident Midland representative for Messrs. Richard Garrett & Sons, Ltd., to join the Alton Battery Co., Ltd., as manager.

Obituary.—MR. M. R. LAWRENCE.—We regret to record the death, which occurred on August 29th, of Mr. Maximilian Robert Lawrence, works manager of the Sterling Telephone and Electric Co., Ltd., Dagenham. Mr. Lawrence was 53 years of age. Previous to taking up his position with the Sterling Company three years ago, he had held managerial posts with well-known engineering concerns, including the Wolseley Tool

and Motor Car Co., Messrs. Vickers, and Burton, Griffiths and Co., Ltd. He was a frequent contributor to the engineering Press and was prominently associated with several engineering institutions.

Will.—The late Mr. A. E. WELLS, managing director of Messrs. Edgar Allen & Co., Ltd., and the Imperial Steel Works, Sheffield, left £49,553 gross, and £46,140 net personalty.

New Companies Registered.

Detex, Ltd. (208,129).—Private company. Registered August 27th. Capital, £600 in 500 8 per cent. cumulative preference shares of £1 each and 400 ordinary shares of 5s. each. Objects: To carry on the business of manufacturers of, agents for, and dealers in wireless apparatus of all kinds, &c. The directors are:—E. L. Conradi, 23, Priory Court, West Hampstead, N.W.6; G. Mellor, 78, Montpelier Road, Hove, Sussex. Solicitors: H. L. Lumley & Co., 35, Piccadilly, W. Registered office: 59, New Oxford Street, W.C.1.

Spectrome, Ltd. (208,134).—Private company. Registered August 29th. Capital, £1,000 in 900 7 per cent. cumulative participating preference shares of £1 each and 2,000 deferred shares of 1s. each. Objects: To carry on the business of engineers, advisers, experts, consultants and contractors in connection with wireless telephony or telegraphy, also tele-optical and any allied or other sections of science, &c. The directors are:—H. S. Taylor, 39, Hillmarton Road, N.7; A. E. Cooke, 53, Graham Road, E.8. Qualification, £50 shares. Remuneration as fixed by the company. Secretary: S. H. Taylor. Registered office: 39, Hillmarton Road, N.7.

Red Seal Products, Ltd. (208,196).—Private company. Registered September 2nd. Capital, £1,000 in £1 shares. Objects: To adopt agreements (1) with Sexton-Barnes, Ltd., (2) with C. Cassell, and (3) with L. B. Tickle and G. F. Pickering, and to carry on the business of merchants, dealers, factors and sales agents of radio instruments, fittings, apparatus and accessories, and articles particularly of the Red Seal loud speakers. The directors are:—C. Cassell, 30, Torrington Square, W.C.1, merchant; L. B. Tickle, 58, Gonville Road, Thornton Heath, engineer; G. F. Pickering, 33, Cranbourne Gardens, N.W.11, engineer. Qualification, £1. Remuneration, £5 each per annum. Secretary: R. J. Boning. Registered office: 32-34, Theobalds Road, W.C.1.

Telephos (1925), Ltd. (208,225).—Private company. Registered September 3rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers, importers or exporters of and dealers in gas and electrical fittings and appliances, and apparatus for wireless telephony, &c. The directors are:—R. H. Bye, 116, Bellingdon Road, Chesham, engineer; Agnes M. Bye, 116, Bellingdon Road, Chesham, secretary; H. L. Down, 6, Sunningfields Crescent, Hendon, N.W., engineer. Qualification, 50 shares. Registered office: The Gardens, Vaughan Road, Harrow.

Roto-Sign Co., Ltd. (208,281).—Private company. Registered September 7th. Capital, £25,000 in £1 shares. Objects: To acquire the business of electric sign manufacturers, electrical and general engineers, illuminating and decorating contractors and general merchants and importers carried on by W. A. McMullen and S. Jarratt at 122, Shaftesbury Avenue, W., as the "Roto-Sign Company." The permanent directors are:—S. Jarratt, 5, Harvard Court, West Hampstead, N.W.6, electrical engineer; and W. A. McMullen, 122, Shaftesbury Avenue, W., electrical engineer. Qualification, £100. Remuneration as fixed by the company. Solicitors: Cooper, King and Co., 6, New Court, Lincoln's Inn, W.C.2.

Avenue Motor Co. (Hull), Ltd. (208,127).—Private company. Registered August 29th. Capital, £1,000 in £1 shares. Objects: To acquire the business now carried on at 84, Prince's Avenue and Henderwell Street, Hull, as the Avenue Motor Co., and to carry on the business of motor garage proprietors, motor hire contractors and motor manufacturers, repairers and dealers, electrical engineers, dealers in all kinds of electrical goods, including wireless, telegraph and telephone apparatus, &c. The directors are:—C. S. Mason, 84, Prince's Avenue, Hull; J. C. Townsley, 105, Park Avenue, Hull. Qualification, £100 shares.

Battery Plates, Ltd. (208,100).—Private company. Registered August 28th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers of battery plates, magneto spare parts, magnetos, ignition apparatus, wireless and all classes of electrical apparatus and appliances, &c. The directors are:—P. Forrester, Ballochingle, Blundellsands, Liverpool; J. Myles, 15, Lichfield Drive, Sedgley Park, Manchester, accountant; and W. H. Hodgson, 61, Eccles Old Road, Pendleton, Manchester, electrical engineer. Qualification, £25. Secretary: H. H. Venables. Solicitors: Doughty & Fraser, 17, Market Street, Manchester.

Manchester Magneto Co., Ltd. (208,221).—Private company. Registered September 3rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, and dealers in magnetos and spare parts, ignition, and all classes of electrical apparatus, electricians, electrical engineers, manufacturers of, and dealers in electrical equipment used on motor vehicles, wireless equipment, &c. The permanent directors are:—F. E. Waring, 48, Parrs Wood Avenue, Didsbury, Manchester, engineer; H. V. Barker, 48, Parrs Wood Avenue, Didsbury, Manchester, engineer. Qualification, 100 fully-paid shares. Remuneration as fixed by the company. Solicitor: F. O. S. Leak, 6, John Dalton Street, Manchester. Registered office: 29, Liverpool Road, Manchester.

Official Returns of Electrical Companies.

Edwards & Armstrong, Ltd. — Mortgage dated August 11th, 1925, to secure £1,500, including £950 advanced by the company's predecessor in title, charged on "The Lawn," Cainscross, Glos. Holders: Trustees of the Stroud Holloway Original Benefit Society.

Acme Electric Wire and Cable Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital dated August 18th, 1925, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Robert Crust, Ltd. (184,087).—Return dated December 31st, 1924 (filed February 26th, 1925). Capital, £1,000 in £1 shares. 999 shares taken up. £698 paid. £301 considered as paid. Mortgages and charges, nil. Return of allotments, made up to April 7th, 1925, shows the remaining share allotted for cash.

Pickvance, Ltd. (183,595).—Return dated December 1st, 1924 (filed March 2nd, 1925). Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. 1,602 ordinary and 600 preference shares taken up. £650 paid on 200 ordinary and 450 preference shares. £952 considered as paid on the remainder. Mortgages and charges, £1,650.

Gayton Park Electricity Co., Ltd. (184,208).—Return dated April 6th, 1925. Capital, £3,000 in £1 shares. All shares taken up. £3,000 considered as paid. Mortgages and charges, nil.

Energy Syndicate, Ltd. (184,206).—Return dated March 9th, 1925. Capital, £15,000 in 8,250 preference and 6,750 ordinary shares of £1 each. All shares taken up. £15,000 paid. Mortgages and charges, nil.

Excelsior Magneto and Ignition Co., Ltd. (183,735).—Return dated December 31st, 1924 (filed March 26th, 1925). Capital, £1,000 in £1 shares. All shares taken up. £1 per share called up on 870 shares. £720 paid, leaving £150 in arrears. £130 considered as paid. Mortgages and charges, £300.

Highfield Electrical Co., Ltd. (184,119).—Return dated August 13th, 1925. Capital, £2,500 in £1 shares. 1,802 shares taken up. £1,800 paid. £2 in arrears. Mortgages and charges, nil.

Friend, Wintle & Co., Ltd.—F. J. Alban, of 84, Queen Street, Cardiff, was appointed receiver on August 21st, 1925, under powers contained in debenture dated June 29th, 1923.

E. Saunders (Margate), Ltd. (183,719) (formerly the Margate and District Electrical Co., Ltd.).—Return dated May 3rd, 1924 (filed February 21st, 1925). Capital, £3,000 in £1 shares. 20 shares taken up. £20 paid. Mortgages and charges, nil.

Wickford and District Electricity Supply Co., Ltd. (183,455).—Return dated December 31st, 1924 (filed February 27th, 1925). Capital, £5,000 in £1 shares. 2,051 shares taken up. £2,051 paid. Mortgages and charges, nil.

Cullompton Electric Supply Co., Ltd. (183,058).—Return dated July 16th, 1925. Capital, £6,000 in £1 shares. 3,848 shares taken up. £3,248 paid. £600 considered as paid. Mortgages and charges, nil.

British Electrical Maintenance and Insurance Co., Ltd. (182,942).—Return dated December 5th, 1924 (filed February 28th, 1925). Capital, £1,000 in £1 shares. 999 shares taken up. £999 paid. Mortgages and charges, nil.

Radiant Electrical Co., Ltd. (182,866). — Return dated January 14th, 1925. Capital, £100 in £1 shares. 100 shares taken up. £100 paid. Mortgages and charges, nil.

John Richards & Co. (Electrical Engineers), Ltd. (183,000).—Return dated December 19th, 1924. Capital, £6,000 in £1 shares. 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges, nil.

Power Securities Corporation, Ltd. (184,817).—Return dated March 3rd, 1925. Capital, £2,000,000 in 1,000,000 preference and 1,000,000 ordinary shares of £1 each. 500,000 preference and 500,000 ordinary shares taken up. £1,000,000 paid. Mortgages and charges, nil.

City Notes.

Reports and Meetings of Electrical Companies; Dividend Results, &c.

Scarborough Electric Supply Co., Ltd.—At the annual meeting on August 31st, formal approval was given to the proposed sale of the undertaking to the Scarborough Corporation as from December 31st next. The chairman (Mr. A. A. C. Swinton) said the terms of actual purchase were in accordance with the conditions of the original deed of transfer of the undertaking. The negotiations to date had been conducted amicably. It was unfortunate that the company was to be wound up when the undertaking had become prosperous, but that could not be helped. Obviously the Corporation was anxious to acquire it because it was prosperous.

Ferranti, Ltd.—The report for the year ended June 30th last records a gross profit of £165,982, as compared with £134,569 in the preceding year. After meeting all charges, including the transfer of £15,000 to depreciation reserve (against £10,000), there was a net profit of £67,644, as compared with £55,545. It is proposed to place £40,000 to reserve (against £35,000); to pay a dividend of 20 per cent., free of tax (as compared with 15 per cent. in 1924); and to carry forward a balance of £33,313. The meeting is to be held to-day (Friday).

Stratford-on-Avon Electricity Co., Ltd.—At the recent annual meeting it was stated that, with the incorporation of the parish of Alveston in the area of supply, additional plant had become necessary to cope with expanding business. It was intended to issue £10,000 first mortgage debentures bearing interest at 6½ per cent. The recommendations were approved, and at an extraordinary general meeeting, which followed, a resolution was adopted empowering the directors to borrow £10,000.

Stewarts & Lloyds, Ltd.—The following dividends have been declared in respect of the half year to June 30th:—At the rate of 6 per cent. on the preference shares; and at the rate of 10 per cent. on the preferred ordinary shares. Similar dividends were paid last year.

North American Light and Power Co.—The whole of the company's first lien 6 per cent. gold bonds, maturing normally in 1937, have been called for redemption at 102½ per cent. and accrued interest.

Hurst, Nelson & Co.—A final dividend of 2s. 6d. per share has been declared, making 3s. 6d. for the year. Last year the dividend was 4s., but the capital has since been increased.

Western Telegraph Co., Ltd.—The directors have declared a final dividend of 5s. per share, making 10 per cent., free of tax, for the year, as in 1924.

Hendon Electric Supply Co., Ltd.—An interim dividend of 1s. per share, free of tax, has been declared on the ordinary shares.

British Electric Transformer Co., Ltd.—A dividend of 3½ per cent. has been declared in respect of arrears on the preference shares.

Mississippi River Power Co.—A dividend of 1½ per cent. on the preferred stock is announced.

Stocks and Shares.

MONDAY EVENING.

THE principal changes in the Stock Exchange lists since a week ago are rises which reflect the satisfaction felt with the recognition that is being accorded to Mexico by the British Government. On the top of the substantial recoveries to which reference was then made here, further improvements have occurred, ranging from 1 to 5 points, the latter gain being secured by Mexican Light & Power common and preferred shares alike. Mexico Tramway 5 per cent. bonds are a point down, which seems a little anomalous in view of the strength shown by the other Mexican issues. Doubt is not altogether satisfied, even yet, as to whether this recognition will automatically bring in its train the improvement in Mexican conditions that will assuredly restore British industries in Mexico, to profitable working conditions. Each day, however, adds to the assurance that the British Government and the Mexican Government are both in earnest, and that the preliminaries are definitely settled.

Other foreign traction utility stocks are better. British Columbia preferred at 80½ shows a rise of 3 points, and the deferred holds its gain of 3½ secured a week ago. Anglo-Argentine Tramways 5 per cent. debenture stock at 76½ is 1 better. Brazilian Tractions shot up to 74½, thanks to the strength of the milreis. The company is now regarded as being upon a 5 per cent. dividend basis.

Electricity supply shares show few movements. London Electrics, after their rise of 4s. 6d., have shed 6d., going back to 35s. middle. Charing Cross ordinary are better at 2½. Charing Cross City undertaking is thought likely, as already mentioned here, to receive slightly more favourable treatment in the reorganisation proposals than the other members are, though the difference is not likely to be material. County ordinary have dropped back to 57s., a reaction of 1s. 9d. Midland Counties at 22s. 9d. are 6d. lower. St. James's gained ¼ at 14¼. Urbans at 18s. 3d. are 1s. 3d. higher. There is a steady demand for the debenture stocks and the preference shares of the various companies, and the supply on offer diminishes week by week.

Amongst the Electricity Supply ordinary shares, which can be bought are 500 City Lights at 48s. 6d. x.d., to yield 6¼ per cent.; 500 Counties at 59s. *cum* dividend, paying £5 1s. 6d. per cent., and 1,000 Westminsters at 44s. 6d. x.d., where the yield is 6¾ per cent. There are also on offer 1,000 Electric Supply ordinary at 31s. 9d., to yield £6 18s. 6d. on the basis of the last dividend of 11 per cent. English Electrics at 19s. 3d., of which a few hundreds are available, yield 5¼ per cent., and Edmundsons at 22s. 6d., at which price there are 1,000 shares offered, give 6¼ per cent., taking the 7 per cent. dividend, paid annually for the past three years, as the basis of calculation. Midland Counties ordinary at 23s. 3d. yield £5 3s. 6d. per cent., and Newcastle ordinary at 23s. 6d., *cum* the recently-declared dividend, return just under 6 per cent. on the money; Llanelly ordinary at 20s. x.d. offer the level 7 per cent. Clyde Valley ordinary at 30s. give £5 6s. 8d. per cent., and Yorkshire ordinary at 30s. return a similar sum. There are also obtainable 500 Brompton ordinary at 36s. x.d., where the yield is £5 11s. per cent. net, the dividend being paid free of tax. The prices are given as a rough guide. Purchasers will probably find they can buy more cheaply when they come to deal.

Marconis are beginning to look up again. It has been contended for some time past in the market that Marconis have distinct attractions at anything like 25s., and this view seems to have aroused a little following, with the result that the price, although nominally unchanged at 25s., is, actually, rather better. Canadian Marconis came in for attention at the same time, and the price rose 7½d. to 5s. 1½d. middle. The latest invention of Signor Marconi in the shape of wireless "light-houses" may have something to do with the greater interest which is being taken in the shares of the company which bears his name, and which, after all, pay 8 per cent. on the money, with future prospects that are difficult to estimate.

The Home railway market is as heavy as ever. Most of the steam stocks are substantially lower in price on the week. Underground Electric income bonds at 96 are ex the 3 per cent. net dividend deducted from the price last Tuesday. The public are taking no interest, however, in Home Railway stocks, the reason being the continual disturbances which occur in labour circles and which all appear to extend into the railway world by one path or another.

Great Northern Telegraphs are a feature of strength at 32½. Otherwise, the cable group is uninteresting. Automatic Telephones jumped to 45s., thus showing a gain of 3s. The market in the shares is now so limited as to render any demand liable to have a disproportionate effect upon the price of the shares. International Telephones are 26s. buyers. Cuba Telephone 5 per cent. bonds at 93½ have risen 2 points.

The manufacturing shares retain their strength, and Edisons have spurted a shilling to 9s. per share. General Electrics lost 6d. of their florin rise, and English Electrics are a little easier at 19s. 3d. British Electric Transformer preference strengthened to 18s. 9d., but the other preference shares in this group are exceedingly well held. Babcocks, amongst the engineering shares, receded to 2½, the iron and steel market being heavy. Rubber shares, after a slight depression due to a fall in the price of the commodity to 3s. 2d. per lb., hardened up again as buyers came forward to take stock for the new Stock Exchange settlement which started on the Tuesday in this week.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Sept. 7. 1925.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	13	14	3	—	4 13 4
Brompton Ordinary	1	10	10	1⅝	—	*5 14 3
Charing Cross Ordinary	1	14½	15	10/-	- 6d.	6 2 5
do. do. 4½ Pref....	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	12	1⅞	—	6 8 0
City of London	1	15	15	48/3	—	6 4 4
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 6
County of London	1	15	15	57/-	—1/9	5 5 3
do. do. 6% Pref.	1	6	6	2 /-	—	5 4 4
Edmundson's Ordinary	1	7	7	22/-	—	6 7 3
do. 7% Pref.	1	6	7	21/6	—	6 10 3
Elec. Supply Corporation ...	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	14	15	12⅝	—	5 18 8
Lancs. Light and Power	1	7½	7½	26/6	—	5 15 5
London Electric	1	10	10	35/-	—6d.	5 14 3
do. do. 6% Pref.... ...	5	6	6	5½	—	5 7 10
Metropolitan	1	10	11	39/6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	22/9	—6d.	5 5 6
Newcastle-on-Tyne Ordinary ...	1	6	7	23/3	—	6 0 5
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	14¼	+ ¼	6 2 10
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref. ...	1	7	7	1¾	—	5 12 0
Urban Ordinary	1	4	4	18/3	+1/3	4 7 8
do. 6% Pref. ...	1	6	6	19/6	—	6 3 1
Westminster Ordinary	1	15	15	44/-	—	6 16 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	29/-	—	5 10 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	66	—	6 1 3
Metropolitan	,,	4	5	67½	— ½	7 8 2
do. District	,,	3½	3½	43½	—1	8 0 11
Underground Electric Ordinary	10	Nil	Nil	2½	—	Nil
do. do. "A" ...	1/-	Nil	Nil	7/-	—	Nil
do. do. Income	Bonds	6	6	96xd	—	*6 5 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 15 11
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	3	6	45/-	+3/-	2 13 4
Chili Telephone	5	6	5	5½	—	*4 11 0
Cuba Sub. Ord.	10	5	5	6⅞	—	7 8 2
Eastern Extension	10	10	10	17½	—	*5 15 11
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 15 11
Globe Tel. and T. Ord.	10	10	10	17⅞	— ⅜	*5 13 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	22	32½	+ ½	6 15 6
Indo-European	25	7	8½	41½	—	*5 2 5
Marconi	1	10	10	1¼	—	8 0 0
Marconi Marine	1	10	7½	17/6	—	8 11 6
Oriental Telephone Ord. ...	1	12	12	2	—	*6 0 0
United R. Plate Tel.	5	8	8	7½	+ ¼	5 6 8
Western Telegraph	10	10	10	16¼	—	*6 3 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅞	—	8 0 0
do. do. 2nd Pref. ...	5	6	6	3⅜	—	8 17 10
do. do. 5% Deb. ...	Stock	5	5	75½	+1	6 10 9
British Electric Traction Ord. ...	,,	6	6	116½	+2	5 3 0
do. do. 6% Pref. ...	,,	6	6	105	—	5 14 3
Brazil Traction	100	4	4	74½	+4	5 7 5
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	88½	—	5 11 9
do. do. Preferred	,,	96/-	96/-	88½	+3	*5 7 8
do. do. Deferred	,,	129/5	129/5	109½	—	*5 18 3
do. do. Deb.	,,	4½	4½	77½	—	5 9 8
Lond. & Sub. Trac. 5% Pref. ...	1	2½	Nil	4/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	49½	—	9 8 4
Mexico Trams, 5% Bonds ...	—	5	5	60½	—1	8 5 4
Mexican Light Common ...	100	Nil	Nil	32	+5	Nil
do. Pref.	100	Nil	Nil	£2	+5	Nil
do. 1st Bonds ...	—	5	5	69½	+4	7 3 11
Yorkshire (West Riding) ...	1	5	—	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	2½	— ¼	*4 16 0
British Aluminium Ord.	1	5	10	1⅞	+ 1/16	5 14 3
British Elec. Transformer Pref.	1	Nil	7	18/9	+1/3	... ...
British Insulated Ord.	1	15	15	3⅞	—	4 12 4
Brush Ord.	1	10	10	23/3	—	8 12 0
Callenders	1	15	15	3¾	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	⅜	—	... ...
Edison-Swan	4/-	10	10	9/-	+1/-	4 8 11
do. 5% Deb.	Stock	5	5	80½	—	6 4 3
Electric Construction	1	10	10	30/6	—	6 11 2
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/3	—3d.	5 3 11
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	23/9	+3d.	5 9 5
do. Ord.	1	5	7½	27/6	—6d	5 9 1
Henley	1	15	16	3½	—	4 18 6
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	22/-	—	*4 10 11
Johnson & Phillips	1	10	10	49/6	—	3 14 9
Met-Vickers, Ord.	1	8	8	24/6	—	6 10 8
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	1½	—	8 0 0
Telegraph Construction	12	20	20	26½	—	4 10 0

* Dividends paid free of Income Tax.

The British Association.—III.

The Southampton Meeting.

The Study of Wireless Wave Fronts by Directional Methods.

By R. L. SMITH-ROSE.

(*Abstract of Paper read before Section A.—Mathematical and Physical Science.*)

The directions of the electric and magnetic forces in a simple wave are at right angles to each other and mutually perpendicular to the direction of propagation of the wave. The plane containing these forces is known as the wave-front. All the existing types of wireless direction-finders operating by reception of the desired signals make use of the fact that for a simple wireless wave propagated along the earth's surface the magnetic force is horizontal and perpendicular to the vertical plane of propagation of the wave. Such direction-finders use, in principle, a closed loop in a vertical plane capable of being rotated about a vertical axis; the loop is turned to the position of minimum or actually zero e.m.f. when the plane of the loop is parallel to the horizontal component of the magnetic field. Various circumstances may, however, contribute to an apparent deviation in the direction of travel of the wave as judged from the direction of the horizontal component of the magnetic field. For example, various objects, such as metalwork, whether above or below ground, trees, tuned aerials and long stretches of overhead wires may cause an error in the apparent direction, which may be as much as 50 deg. The small residual errors which are experienced are taken into account by calibrating the direction-finding station on various fixed transmitting stations; this is found to be sufficiently constant for practical use, but when the source is an aerial or a system of overhead wires, the errors are sometimes dependent upon the electrical circuit constants of these, and more care or frequent repetition of the calibration is necessary for accurate working. In the cases of steel ships and aircraft the error in apparent direction varies in an approximately sine-wave form with the direction of the incoming waves relative to the fore-and-aft line of the ship. In such installations, either a correction curve is prepared from observations taken while the ship is swung on a fixed transmitting station, or sometimes the error is approximately compensated for by some suitable circuit arrangement. With regard to diurnal variations, when the range of transmission in which a direction-finder is used exceeds certain minimum values, the apparent direction of arrival of the waves is subject to somewhat erratic variations, the frequency and magnitude of which are dependent to a limited extent upon the wave length employed, the distance of the transmission, and also upon the time of year and part of the day. The apparent bearings of a fixed station on a direction-finder are in general continually varying at a rate which is roughly inversely proportional to the wave-length employed.

Discussing land and sea effects, and the application of wireless direction-finding to navigation, the author said that when the path of transmission is entirely overland, the difference in variations by day and night becomes apparent at distances of about 30 miles. When, however, the path of transmission is entirely oversea, this minimum distance for serious variation is trebled. This is fortunate, since ranges at which wireless direction-finding is required in marine navigation are seldom greater than 50 and never more than 100 miles, and a suitable choice of the land station ensures that this range is entirely oversea. Under such conditions, about 95 per cent. of the observed bearings fall within a 2-degree limit of error, which is found to be adequate for most navigational purposes. When the line of transmission is almost parallel to a coast there is a liability of errors due to a coastal refraction effect, and it will probably be customary in the future to mark all charts with "arcs of good bearings" for the various land stations used for direction finding. The above facts have been established almost entirely for damped wave transmission on a wave-length of 450 metres, but there is as yet no definite evidence that they will need modification by the employment of undamped waves or of any other wave-lengths within reasonable limits. When using a direction-finder it is sometimes necessary to rotate the coil for some 5 to 20 deg. before any change in the signal intensity can be detected. This is due to the fact that the horizontal component of the magnetic force of the arriving waves is no longer strictly linear, but of elliptical rotating form, probably due to the arrival of two waves differing in phase and amplitude. It is evident that the apparent direction of arrival of the waves as given by the rotating force will be perpendicular to the major axis of such an ellipse. An extreme case of this phenomenon is sometimes obtained in the form of circular polarisation. This results in the signal received on the closed coil direction-finder being of uniform intensity for a complete rotation of 360 deg. While on waves of from 2,000 to 13,000 metres, the occurrence of such circular fields is comparatively rare, on the shorter waves of from 150 to 1,000 metres it is so frequent during the night periods that no definite bearing can be ascertained in from 10 to 50 per cent. of cases.

If a closed loop receiver is provided with a horizontal as well as a vertical axis of rotation, a means is provided for the determination of the angle of inclination of the magnetic force to the horizontal plane. To do this, the position of the coil to give a minimum of signal strength with its plane vertical is first determined. It is then rotated through 90 deg., so that the horizontal axis is perpendicular to the horizontal component of the magnetic field. By then rotating the coil about its horizontal axis, the inclination of the magnetic force is determined. In the case where the horizontal force is not linear, it is necessary to repeat this last rotation for a second position of the horizontal axis at right angles to the first. If, as may occur under certain conditions, the resultant magnetic force being examined is elliptically or circularly polarised in space, the above methods enable only the components on three mutually perpendicular planes to be determined, two of these planes being vertical and the third horizontal. In the case of such of these components as are not linearly polarised, only the direction of the major axis can be determined. With regard to the electric force, instead of a closed coil for reception, a straight open wire aerial may be used in the form of a Hertzian rod. In this case the e.m.f. induced will depend upon the component of the electric force parallel to the rod. Hence, if such a Hertzian rod be supported at its midpoint, coupled to suitable receiving apparatus, and rotated about a horizontal axis, a position of zero or minimum signal strength will be found when the rod is perpendicular to the electric force if it is linearly polarised, or to the major axis if it is elliptically polarised. If the horizontal axis of rotation is parallel to the direction of propagation of the wave, the rotation should be repeated about a perpendicular horizontal axis to give a determination of the directions of the components of the electric force on two vertical planes at right angles to each other. When these methods are used it is found that the magnetic force is horizontal and at right angles to the direction of propagation, and the electric force is found to be nearly but not quite vertical, being actually tilted forward by a small amount in the vertical plane of propagation of the wave. It is also found that in this plane the electric force is of slightly elliptically polarised form. The experiments show that the forward tilt of the electric force increases with a reduction in the wave-length employed. The values actually measured in this country range from about 0.5 deg. on 6,900-metre to nearly 3 deg. on 350-metre wave-lengths. From these angles the effective conductivity of the earth at the wireless frequencies employed can be obtained, and has been shown to lie between 0.6 by 10^{-3} and 4.0 by 10^{-3} in e.s.u. for various sites in the south of England.

The author said that one of the most promising theories of wireless wave propagation over the earth's surface implies the reception of one or more waves from the upper atmosphere in addition to the wave propagated directly along the earth's surface. It might be thought at first that the detection of the existence of such a down-coming wave would be a comparatively easy matter by determining the directions of the electric and magnetic forces which result at the receiver. It must be remembered, however, that with the above value of conductivity the earth's surface will act as a moderately good reflector, and the incidence of a downcoming wave will give rise to a reflected wave which may have an amplitude nearly equal at its maximum to that of the incident wave. The combined effect of these two waves is to give a resultant electric force which has no horizontal component, and a resultant magnetic field which has no vertical component. Such a wave, therefore, becomes difficult to distinguish from a horizontally propagated wave by directional measurements. This has been partly confirmed by experimental observations made during the last 18 months. Employing the waves from various transmitting stations using wave-lengths between 2.6 and 12.4 km, the maximum departure of the directions of the electric and magnetic forces from their normal values has been about 1 deg., which was considered to be scarcely greater than the possible error of the apparatus employed. Many of these experiments were carried out at night and for distances of transmission known to give rise to the well-known night effects, these being instanced by variations in apparent bearings ranging up to 23 deg. On the shorter wave-lengths the practical difficulties increase considerably, but some recent measurements made on 385 metres have shown that under suitable night conditions the resultant electric force may depart as much as 12 deg. from its normal day value, while the resultant magnetic force may be inclined at 5 deg. to the horizontal. Experiments are being carried out at the Radio Research Board's station at Slough, in which these observations are made simultaneously with the measurement of various other parameters of the forces of the arriving waves, the results of which will probably produce valuable evidence on the problem of the propagation of wireless waves over the earth's surface, which has recently become, perhaps, the most important scientific subject in radio research.

The Efficiency of Marine Auxiliary Machinery.

By STANLEY S. COOK, B.A.

(*Abstract of Paper read before Section G.—Engineering.*)

In the course of this paper the author said that a review of the history of the steam turbine in marine propulsion disclosed the fact that during the past 20 years there had been

an increase of practically 100 per cent. in overall efficiency, made up of improvements in turbine and propeller efficiency, principally through the introduction of gearing between turbine and propeller, and an increase of available energy due to the use of superheat. Since economy in total fuel consumption was the ultimate aim, whilst the highest efficiency of conversion of heat into power was necessary on the part of the main engines which propelled the vessel, consideration must be given to the question of auxiliary machinery which with the improvements that had been made to reduce the consumption of the main machinery, was now responsible in a complete installation for a very appreciable percentage of the total fuel consumption. Wasteful auxiliary machinery, either through unsatisfactory provision in the first place, or through want of care in its maintenance and management, had not infrequently in the past been the cause of a poor overall performance for which the propelling machinery had been blamed.

Taking a typical case of a vessel with high-efficiency turbines developing 5,000 shaft h.p., the author discussed the estimated consumption of the auxiliary plant which comprised air pump, ejector, circulating pump, feed pump, fans, oil pump, steering gear, electric lighting set, &c. Four different methods of driving the auxiliaries were considered, *viz.*, (1) Entirely by steam; (2) by electric motors with energy supplied by turbo-generators; (3) by electric motors with energy supplied by Diesel generators; and (4) mechanically from the main engines. In proposal (1) the steam consumption of the auxiliaries, including the ejector steam, the make-up feed, and the steam used for the evaporator, was calculated at 8,960 lb. per hour. Of this 1,500 lb. was condensed in the evaporator coil and 250 lb. in the oil-fuel heater, leaving 7,210 lb. available for feed heating. To heat the remainder of the feed water from 70 to 215 deg. F. required 5,800 lb. of steam, leaving 1,410 lb. unutilised, which might either go to the winch condenser or be led to the low-pressure turbine. The total steam consumption for all purposes, in this case, was therefore 44,960 lb., per hour, or 8.99 lb. per shaft-h.p.-hour. With a feed-water temperature of 215 deg. F., 13.2 lb. of steam at 500 lb. per square inch and 700 deg. F. could be generated for each pound of oil consumed in the boiler furnace. This figure was based on a calorific value of 18,500 B.th.u. per pound and a boiler efficiency of 84 per cent., which could be attained with efficient pre-heating of the furnace air. On that basis, a steam consumption for all purposes of 8.99 lb. per shaft-h.p.-hour corresponded to an oil-fuel consumption of 0.681 lb. per shaft-h.p.-hour. By utilising steam tapped off from the turbines to raise the feed temperature to 310 deg. F., whilst slightly more steam was required, this was generated at a higher evaporative rate, and the oil consumption per shaft-h.p. was reduced to 0.667 lb. That was the case with proposal (1) with the auxiliaries steam driven. The total brake-h.p. required for the auxiliary machinery was 118.5.

In proposals (2) and (3) that power was supplied by electric motors, absorbing, with a reasonable allowance for motor and transmission losses, 110 kW. In proposal (2) the 110 kW was supplied by turbo-generators taking steam at the same pressure and temperature as the main turbines, but exhausting to a back pressure of 10 lb. above atmosphere. For the consumption of 45 lb. per kW, they required 4,950 lb. of steam per hour. With the same supply of steam as before for ejectors, make-up feed and evaporator, *viz.*, 2,700 lb., the total auxiliary consumption in this arrangement was therefore 7,650 lb. per hour, giving a total consumption for all purposes of 43,650 lb. per hour, or 8.73 lb. per shaft-h.p.-hour. With 1,500 lb. per hour condensed in the evaporator coil and 250 lb. in the oil-fuel heater, there remained 5,900 lb. per hour of auxiliary exhaust steam which was sufficient to heat the feed water to 215 deg. F. The steam consumption of 8.73 lb. per shaft-h.p.-hour for all purposes then corresponded to an oil-fuel consumption of 0.662 lb. per shaft-h.p.-hour, on the same basis of boiler efficiency, &c., which was further reduced to 0.648 lb. per shaft h.p.-hour by using tapped-off steam to heat the feed water to 310 deg. F.

In proposal (3) the 110 kW required for the motors was supplied by Diesel generators. The additional steam for ejectors, make-up feed and evaporators was, in this case, 2,450 lb. per hour, with only 850 lb. per hour available for feed heating. Since, however, in this case, 4,950 lb. per hour was required to heat the feed to 215 deg. F., this 850 lb. must be supplemented by 4,100 lb. of steam tapped off from the low-pressure turbine belt, at the expense of a reduction of the power developed in that turbine by 285 s.h.p. At a consumption of 0.75 lb. of oil per kW, the Diesel generators consumed 82.5 lb. of oil per hour, which, at an evaporative rate of 13.2 lb. per pound of oil, was equivalent to 1,090 lb. of steam per hour. So that, finally, for this proposal, 4,715 s.h.p. was obtained for a total equivalent consumption of 39,540 lb. of steam for all purposes, or at the rate of 8.39 lb. per s.h.p.-hour. The oil consumption was 0.635 lb. per s.h.p.-hour with a feed temperature of 215 deg. F., and 0.62 lb. with a feed temperature of 310 deg. F., using steam tapped off from the turbines.

In proposal (4) the 118.5 brake-h.p. required for the auxiliary machinery was assumed to be supplied mechanically from the main turbines. With allowance for mechanical losses, it was assumed that the output of the main turbines would thereby be reduced by 132 s.h.p. As in proposal (3) it would also be necessary to bleed 4,100 lb. of steam from the low-pressure turbine for feed heating, involving a loss, as before, of 285 s.h.p. So that with this arrangement steam consumption was increased by 2,450 lb. per hour and output reduced by 417 s.h.p., or a total consumption of 38,450 lb. per hour for an output of 4,583 s.h.p., or 8.39 lb. per s.h.p.-hour. This was the same as for proposal (3), and the oil fuel consumed per s.h.p. was also the same as for proposal (3).

Summarised the results were as follow: For proposal (1) with steam-driven auxiliaries, 0.667 lb. oil per shaft h.p.-hour; for proposal (2), with motor-driven auxiliaries and turbo-generators, 0.648 lb.; for proposal (3), with motor-driven auxiliaries and Diesel generators, and for proposal (4), with auxiliary machinery mechanically driven from the main engine, 0.62 lb. Thus with steam-electric auxiliaries the total fuel consumption might be made 2.85 per cent. less than when they were steam-driven, and with Diesel-electric or mechanically-driven auxiliaries 7.6 per cent. less.

In proposal (4), for the sake of simplicity, it was supposed that all the auxiliaries were driven from the main engines. This might not be considered desirable in the case of all of them, even with the provision of adequate stand-by units. The result, however, as regarded fuel consumption being the same as when these auxiliaries were motor-driven from Diesel generators, one could make it apply equally to any combination of the two systems; that was to say, with as many of the auxiliaries as was considered practicable driven mechanically from the main turbines and the rest motor-driven from Diesel generators.

The Rôle of the Atmosphere in Wireless Telegraphy.

By PROF. E. V. APPLETON.

(Abstract of a "Citizens' Lecture.")

IN the course of this lecture, which was delivered at the Avenue Hall on August 29th, Prof. Appleton said that it was nowadays very generally recognised that the atmosphere had a very profound influence on the transmission of electric waves through it, and thus on wireless communication generally. Usually, but not always, the influence of the atmosphere was favourable to communication, and it was now quite certain that long-distance communication was brought about solely by the influence of the ionised layers in the upper atmosphere. In short-distance communication, *e.g.*, up to 100 miles, broadcasting listeners were familiar with another effect which must now be regarded as of atmospheric origin. Most listeners with valve sets were aware that at distances approaching 100 miles from a broadcasting station the signal intensity at night often underwent pronounced fluctuations varying from a loud-speaker intensity down to inaudibility in a minute or so. This "signal fading," as it was called, had been a puzzle for a long time, but experiments recently carried out at the Cavendish Laboratory, Cambridge, by Prof. Appleton and Mr. Bagnett had shown that the effect in such cases was due to the interaction of two sets of waves which reached the receiving station. One set of waves travelled straight along the ground from transmitter to receiver, while the other set was reflected by the upper atmosphere back to the receiver. Sometimes these two sets of waves reached the receiver in step, and their effects were additive, but sometimes they were out of step and tended to neutralise one another. The actual changes were due to the variability of the upper atmosphere, which altered the phase of the waves reflected thence. Theory indicated that fading should be more pronounced on a loop set than on a set with a vertical-wire aerial, and when an experimental test of this point was made at Cambridge with accurate instruments the theoretical prediction was verified. Loop fading was found to be greater than aerial fading, and from the results the angle at which the waves reflected by the upper atmosphere reached the ground again could be measured. The angle was found to be 60 deg. at Cambridge for the signals from 2 LO. From this figure it was clear that the height of the layer could be estimated. This crucial test of larger loop fading than aerial fading might be regarded as the experimental proof of the existence of the "Heaviside Layer," which had been strongly contradicted by German and American radio engineers. At greater distances from broadcasting stations (150-200 miles) the train of waves travelling along the ground was highly attenuated and only the waves reflected from the upper atmosphere reached the receiver, and then only at appreciable intensity at night. The atmosphere was also responsible for the troublesome naturally-occurring signals known as atmospherics. In recent experiments the intensity, duration, and wave-form of these disturbances had been determined, and they had been shown to be due to electrical discharges (*e.g.*, lightning strokes) in the atmosphere. Fortunately the effects of atmospherics were not as marked on the shorter broadcasting wave-lengths as on the longer commercial wave-lengths, and recent experiments in Cambridge showed that the only atmospherics which gave real trouble to listeners could usually be attributed to actual lightning strokes within the British Isles. With longer-range sets of longer wave-length the lightning strokes in the tropics were detectable in England as atmospherics.

The Seat of the Electromotive Force of the Galvanic Cell.

By J. A. V. BUTLER.

(Abstract of paper read before Section B.—Chemistry.)

The discovery of the production of an electric current by galvanic action gave rise to two distinct views of its origin, resulting in a controversy which was waged with considerable zeal for a century, without a decision being reached (cf. Sir Oliver Lodge's comprehensive report, *B.A. Report*, 1884). On the one hand, physical theorists regarded as the chief factor a contact p.d. between the metals, identified with Volta's con-

tact force and an intrinsic property of the metals. On the other hand was the chemical view that the current had its origin in chemical effects at the electrodes. In the course of the nineteenth century, the chemical theory received convincing support from the work of Davy and Faraday, which established the quantitative relation between quantity of electricity and chemical action; the discovery of the relation between the electrical energy produced and the energy of the reaction going on in the cell [Kelvin (1851) had postulated the equality of these. The exact thermodynamical relation was given later by Helmholtz and Gibbs]; and the Nernst conception of the process at metal electrodes which accounted for the effect of concentration. The chemical theory thus appeared to be established on all points. The Volta effect itself was explained as due to chemical action at the surface of the metals. For thirty years the metal junction was practically overlooked as an important contributor to the e.m.f. of the cell. Recent work on the thermionic and photoelectric properties of the metals (Richardson, Compton and Millikan) has, however, conclusively demonstrated the existence of large metal contact p.d.'s. How are these to be reconciled with the chemical theory? The author's theory, based on statistical considerations, includes as different aspects of the whole truth (1) the existence of metal contact p.d.'s between metals, approximately equal to the difference of their thermionic work functions; the relation between e.m.f. and the energy of the chemical reaction expressed in the Gibbs-Helmholtz relation; and the Nernst relation for the effect of concentration.

After the reading of the paper the President (Prof. C. H. Desch) said the paper threw a new light on a very old subject. It was over 40 years ago that Sir Oliver Lodge drew up his statement of our knowledge of the subject at that time and it would therefore be interesting to hear his views now.

SIR OLIVER LODGE, F.R.S., referring first to the presidential address to the Section by Prof. Desch, said that the relation between physics and chemistry was of the utmost interest and whatever might have been the case in the past there was no reason now for any antagonism between the two. With regard to Mr. Butler's paper, although he had had this matter at his fingers' ends 40 years ago he had not looked into it for the past 30 years. He knew that Mr. Butler was taking it up at Swansea and was applying the newer knowledge acquired since then. In 1884 we knew nothing about electrons and it was obvious that the views held then by himself and others, notably the late Lord Kelvin, with whom he had discussed it, must be revised. A very different state of affairs had been shown to exist in the light of our comparatively recent knowledge of electrons and the whole subject required to be pulled out by the roots and put on a proper basis.

Some Technical Problems of Broadcasting.

By CAPT. P. P. ECKERSLEY.

(Abstract of a "Citizens' Lecture.")

In the course of this lecture Captain Eckersley indicated in an interesting manner the early difficulties of the British Broadcasting Co., and outlined the policy and aims of the company as the result of this early experience. He said that at first it was thought that eight stations would be sufficient to cover England and Scotland and give good crystal reception everywhere. It was soon evident, however, that this would not be the case and so the present policy was to have numerous stations or relay stations all over the country with the ideal of providing good crystal reception for everyone within a radius of 30 miles. This in itself, however, would not give that service to the community which it was sought to give, *viz.*, a choice of programme, and so the next ideal was to arrange for stations of higher power which would cover a wider area than the "crystal areas," and in that way make alternative programmes available. Dealing with complaints of interference with the broadcasting by ships, Captain Eckersley reminded his audience that wireless in the working of ships and the saving of life at sea was of much greater moment than broadcasting, which was merely for amusement. He expressed his sympathy with the Postmaster-General in the task which was placed upon him of deciding upon wave-lengths and so on in order that not only might the commercial and other wireless business be carried on but also that the whole of the community might have the benefits of broadcasting. Referring again to the aim of the B.B.C., Captain Eckersley said that the object was to enable every listener to adjust his set at the beginning of the evening once for all and for there then to be no further necessity to tinker with the apparatus any more that evening. One of the difficulties which prevented this at the moment was fading, and he explained in non-technical language how fading was caused and how many curious effects in wireless were produced. It was possible, of course, for certain enthusiasts to be able to pick up stations many miles away, and it was not uncommon for the B.B.C. to receive letters asking why it was not generally possible for this to be done. Such people, of course, knew nothing about the technical side of wireless, and he expressed the hope that people would endeavour to understand that such results, in the present state of our knowledge, were more or less in the nature of "freaks." When the B.B.C. first started something like 50 per cent. of listeners had crystal sets; later the number had risen to 65 per cent., and to-day something like 85 per cent. had crystal sets. In an appeal to the public generally to appreciate the work which the B.B.C. was carrying out, Captain Eckersley assured his audience that the company had ideals based on the idea of service which, however, could only be carried out if there were a due appreciation of obsolescence in the plant used. It was only possible to make due progress if it were realised that development in the art was so rapid that there must be scrapping of plant at more or less frequent intervals in order to keep pace with modern practice. An interesting account was given of the manner in which what has come to be known as simultaneous broadcasting throughout the country is carried on and a picture was drawn of the possibility of extending this to all parts of the Empire and the world in the not far-distant future. In this the "beam station would play an important part. Finally, Captain Eckersley just mentioned the problem which faced wireless engineers in giving out at the loud speaker exactly what was put in at the transmitting station. There were the problems of the microphone, transformers, transmitters, the valves on the receiving sets, and the high- and low-frequency magnification, the transformers on the sets, the telephones and, finally, the human ear. Reference was made to the efforts at the London studio to control echo and to how experience was beginning to teach that different types of transmission such as chamber music, orchestral music, speech and so on, required to be treated differently as regarded transmission if the best results were to be obtained in the final telephones and loud speakers. Whatever were the defects of broadcasting as it was to-day, the public was asked to have patience and to appreciate that even if only it was the means of bringing the outside world into close touch with those who had to live in parts far removed from large towns, or if it were only to bring relief and amusement to invalids and aged people, it would still be a wonderful thing. It was doing that, and a great deal more already, whilst it could be looked to for providing communication in the future not only throughout the Empire but throughout the world. The speaker paid a high tribute to the manner in which the Post Office telephone authorities co-operated with and assisted the B.B.C. in the matter of telephone lines for the purpose of simultaneous broadcasting.

THE CHAIRMAN, in proposing a vote of thanks to Captain Eckersley, pointed out that although the efficiency of the telephone was only 10 per cent., the efficiency of radio-telephony was at present only one-tenth of one per cent. This indicated the scope that there was for improvement.

Some Thermionic Valve Problems.

By PROF. E. V. APPLETON.

(Abstract of Paper read before Section A.—Mathematical and Physical Science.)

In this paper three typical problems were discussed:—

(1) *The Internal Action of Thermionic Valves.*—An attempt was made to explain the shape of the static characteristics of thermionic valves and the electronic relations necessary for amplification. It was shown that to explain the characteristics it must be assumed that all the electrodes (filament, grid and anode) emit electrons and that under certain conditions the anode emission, due to electronic bombardment, may be almost as high as the filament emission. The amplification factor of a valve was defined as the ratio of the number of lines of electric force ending on the grid to the number ending on the anode when the grid and anode were maintained at the same potential. From this it could be seen that if the electrons followed the lines of force, the ratio of the grid current to the anode current, for equal grid and anode potentials, should be equal to the amplification factor. But since the measured ratio was always less than that value, it was concluded that the electrons did not follow the lines of force and that they shot through the interstices of the grid to be caught by the anode. For marked amplification, therefore, the grid should be very effective in attracting the electrons but very ineffective in catching them. An experimental bridge method of measuring the amplification factor of any type of valve was outlined. This consisted in filling the space between the electrodes with badly conducting material, *e.g.*, dilute copper-sulphate solution, and measuring the ratio of grid current to anode current when the grid and anode were maintained at the same potential with respect to the filament.

(2) *The Lag in the Action of Thermionic Valves.*—The internal resistance of a thermionic valve was measured for different times of applied voltage and it was found that as the time of applied voltage was increased the internal resistance increased, reaching a constant value for a steady potential. This indicated that for a sudden increase of grid or anode potential, the electron current always jumped first to a value somewhat higher than its final value. The time required to get to equilibrium value might be as long as half a second. The phenomenon was not due to the lag in the response of electron motion to applied voltage, which must be nearly instantaneous, but was due to the alteration of the thermal condition of the filament consequent on the closing of the anode circuit. The true electron emission of the filament was reduced when the anode circuit was closed and space current flowed. The filament was then cooled, due to latent heat being required for the evaporation of the electrons. The effect of the anode current on the filament was to make the negative end hotter than the positive end, the emission of the negative half being 50 per cent. greater than that of the positive.

(3) *Oscillation Hysteresis (or "back-lash") in Valve Generators.*—It had been found that the limiting conditions for starting and stopping oscillations in the valve generator were often not the same. A valve oscillator might have zero amplitude (non-oscillating condition) and yet a sudden electrical impulse might make it burst into oscillation. This phenomenon was of importance in broadcasting reception when

it often happened that listeners worked with too strong reaction, and the set, though naturally stable when left undisturbed, was caused to oscillate violently by a strong atmospheric. This oscillation-hysteresis (first type) was shown to be due to the shape of the valve characteristic. Another kind of oscillation-hysteresis (second type) had also been found. It was possible to make a set oscillate with one of the possible and stable amplitudes for the same operating conditions. Which of the two amplitudes was obtained depended on the method of approach to the set of conditions in question. To make oscillation jump from the smaller amplitude to the larger, it was only necessary to move a magnet rapidly near the valve. This second kind of oscillation-hysteresis was shown to be due to the damping in the grid circuit due to the grid current which affected the dynamic characteristics of the valve so as to give the required type of decrement to the oscillating circuit.

Electrical Trade Prospects in Central America.

An American View.

MR. R. A. LUNDQUIST, Chief of the Electrical Equipment Department of the United States Department of Commerce, has recently completed a tour of what he calls "near-by Latin markets," and has contributed some notes on his investigations to the *Electrical World*. Mr. Lundquist's itinerary included Venezuela, Colombia, Costa Rica, Nicaragua, Panama, San Salvador, Guatemala, and Mexico. He points out that although the standard of living and the level of electrical development are lower than in the United States, conditions are steadily improving. Individually, the countries are not large in population, but their potentialities are great in the aggregate, and with the development of their resources they will undoubtedly become better and better markets in all respects.

Venezuela has a population of only 2½ millions, but there are great oil resources which enhance the country's purchasing power. Electrical service is available in practically all the principal towns, but there is a lack of generating facilities, and the owners of local plants are very backward, and make no effort to extend their undertakings. As a consequence, the service is very poor, and suffers frequent interruptions. The sale of wiring devices and the like has been practically confined to the cheaper classes; there has been apparently little effort to sell higher-class manufactures even among those who are able to buy them.

Conditions in Colombia are very similar, although this country has a larger population (about 5,800,000) and greater oil resources, which, however, have not been developed to such an extent as those of Venezuela. Here, again, the supply authorities are not endeavouring to extend their business, and the rates charged generally preclude the use of domestic appliances.

In Panama there has been a fair amount of electrical development, practically wholly on American lines. The other foreign material is confined to lamps, a few cheap fans, and some low-priced wiring devices of European manufacture. Electric fans are not generally popular, although it is thought that the population could be educated up to them.

Costa Rica, although only having a population of 450,000, is a consistent buyer of American products. With two hydro-electric companies competing for business in the capital, San José, there has been considerable selling activity, and the electrical development of the city has been very good. The standard of illumination is high, and there is a fair use of electrical appliances in spite of high charges. Electric cooking has made great progress, and washers are also used.

Nicaragua is very backward, and the United States' exports of electrical goods have declined considerably. A hydro-electric system was recently initiated in Leon, but for the most part the supply undertakings give a very poor service, the distribution systems being badly constructed. Although American manufacturers obtain the bulk of the orders for electrical equipment, there is an increasing entry of German goods.

One of the most progressive of the countries visited is San Salvador. This has a population of 1,300,000 in a comparatively small area. There is abundant water power, and practically every supply system is hydro-electric. Public electrical utilities are more advanced than in the countries mentioned above, but wiring practice is not on a very high plane. The only electrical appliance that is in use to any great extent is the flat-iron; there is also a small number of electric fans in use. San Salvador has been a fair field for manufacturers of farm-lighting plants; those without batteries are preferred.

The principal central stations in Guatemala are in the hands of an American holding company, and the business is developed on American lines. There is a regular commercial department, with a showroom, and very good results are being obtained. The use of appliances is extending, and, through the influence of the power company, new wiring regulations are coming into force, and electrical contractors in Guatemala City are being licensed, which will naturally result in a higher standard of work. The standard of shop lighting is very high, and high-grade lighting fittings have found a good market. Electric signs are also in extensive use in the city.

Mexico is the most important of the countries visited. This country, which has a population of about 13 millions, has a heavy investment of American capital, and the central-station practice generally follows American methods. Generally speaking, the electrical business in Mexico is fair at the present time, but purchasers are buying in limited quantities, according to local dealers. German manufacturers are very active in Mexico, the Siemens-Schuckert Company having a very large establishment in Mexico City, with branches in the more prominent distributing centres. The Swedish A.S.E.A. is also active in the apparatus field, while Mr. Lundquist also observed "Heemaf" (Dutch) motors. American manufacturers appear to be holding their own, but Germany has taken business on the basis of extraordinary terms in a few instances. In the motor field German competition has only been felt in sizes up to 25 h.p., in which range German manufacturers have a considerable price margin; the quality, however, is not equal to that of American motors. Germans are offering fair quality wiring devices at extremely low prices, and are taking a good deal of the business; in some cases American lines have been closely copied. Appliances have a fair sale in Mexico, but the bulk of the purchases are apparently made by foreigners, except in the case of electric irons.

The general impression gained by Mr. Lundquist from his tour is that in spite of the privileged position which the United States enjoys, American manufacturers are hardly taking full advantage of the possibilities of these adjacent markets. He realises that a good deal of business is lost through a lack of long-term credit facilities, and he thinks that some arrangements could be made to provide these. "It must be realised, of course, that not all of this long-term business is sound, but there must be a worth-while proportion that is safe."

Russian Electrical Notes.

Production of the Manufacturing Works.—During the three months ended with June, which comprised the third quarter of the current Soviet financial year, the total production of the Russian electrical manufacturing works was valued at 25,800,000 roubles, an increase of 13 per cent. over the preceding quarter. The output was divided as to 11.3 millions of roubles among the works of the Central Electrical Trust, 9.9 millions among those of the Electrical Machine Trust, 3.8 millions among those of the Telephone and Telegraph Trust, 472,000 roubles among the Accumulator Trust, and 272,000 roubles among the "syndicated" works. As compared with the second quarter the value of the production in the June quarter was 37 per cent. greater in the case of machines, 18 per cent. in the case of cables, and 16 per cent. in that of telephone and telegraph appliances. The production of lamps remained on the same level as in the second quarter, while some reduction took place in the glass, accumulator and carbon branches of production, within the limits of from 6 to 16 per cent. The personnel increased by 8 per cent. during the quarter, at the end of which the number of workpeople employed throughout all the branches totalled 21,391, together with a staff of 3,569. The average efficiency of the workmen advanced by 4 per cent. over the preceding quarter or 2 per cent. more than had been expected under the productive programme.

Telephone and Radio Apparatus.—The turnover of the Telephone and Telegraph Trust, which also produces radio apparatus, is reported to have considerably increased owing to the development of wireless telegraphy. During the six months ended with March the value of the turnover averaged 730,000 roubles per month, since when it has risen to 1,100,000 roubles per month. As to the actual growth in the business it is mentioned that the value of the uncompleted orders on April 1st, 1925, amounted to 9,000,000 roubles, while orders for 8,000,000 roubles will have been booked by the end of September. The working funds available to the Trust, however, will only allow of the execution of orders representing a total of 11,000,000 roubles by that date unless further financial assistance is received from State funds. An application for this assistance has already been made, and at the same time permission is being sought for greater freedom in the fixing of the sale prices of a number of manufactures. The prices realised for radio apparatus are said to be unprofitable, and the Trust asks for the right to import such appliances so as to regulate the average prices on sales. It is also suggested that the State should assume at least part of the expenses incurred by the Trust in the carrying out of scientific research.

The Donetz Coal Basin.—Dealing with the proposed extension of the electricity supply system in the Southern coal mining region of the Donetz, the Electrification Section of the State Planning Commission points out that the contemplated development is of great significance having regard to the growth of the metallurgical, chemical and other industries in that district. The section has therefore decided to ask the Supreme Council of National Economy to prepare a general scheme for the development of all the industries in the region, including the Donetz Coal Trust, the Southern Steel Trust, the chemical industry and other large undertakings, and to commission the General Electrical Commission to prepare a plan for the construction of new generating stations and a high-pressure network for the distribution of the load as between the industrial works and the stations. So far as concerns the erection of new transmission lines in 1925-26 the section considers it necessary to proceed with the following lines and sub-stations: (1) A

line between Artem and Rostof with a sub-station; (2) a line from Bokovo to Rovenetskoe with a sub-station; (3) a line from Pervomainsk to Karfaren; and (4) a sub-station at the Dumo works. It is considered necessary to ascertain what sums would be provided by the interested works to assist in the erection of the lines.

The Shteroff Station.—The engineer in charge of the constructional works in connection with the Shteroff Station in the coal basin of the Donetz states that the erection of the transmission lines and five sub-stations has begun, as well as the installation of the boilers and one 10,000-kW turbo-generator. A second set of the same size is shortly expected from England. It is intended to set the station in operation on January 1st, 1926, a sufficient load having already been guaranteed. As new industrial works are being brought into service it is proposed to increase the capacity of the station to 36,000 kW in the year 1926-27.

The Supreme Council of National Economy is considering the question of the establishment of a works for producing aluminium in the area of supply of this station.

An E.h.p. Transmission Line.—A successful trial of the 115,000-V line between the Shatur station and Moscow has recently taken place in connection with the experimental working of this station which is to begin this month.

The Republic of Georgia.—The State Planning Commission of Georgia has prepared a five years' scheme of works of electrification, having regard to the prospective demands of industry, transport and improvement works. Besides the hydro-electric works which are in course of construction at the present time the scheme provides for the erection and equipment of a large hydro-electric works on the river Rion in Kutais, and a second on the River Alosani in Kacheti. It is proposed to proceed with the former in the first place so as to be able to afford a supply of energy in the manganese ore district of Chiaturi (the area of the Harriman ore concession). An investigation is also being made into the possibility of constructing a third hydro-electric works on the River Kumistani in Abchazin.

Central Asian Resources.—The Electric Planning Commission has made application to the higher authorities for the assignment of the sum of 2,000,000 roubles for the purpose of conducting an investigation of the sources of energy in the Central Asiatic regions of Uzbekistan and Tadjikistan, so as to ascertain the possibility of the establishment of new branches of industry and the preparation of a detailed plan of electrification.

Electric Port Railways.—The Leningrad Port Administration has prepared a scheme for the construction of electric approach railways to assist in the loading of timber. Negotiations on the question are reported to have already been opened with firms in America, Germany, England, and Italy. The approach lines will have a length of 7.44 miles and a handling capacity of over 1,000 tons per hour. Foreign firms will be allotted orders to the extent of 15 per cent. of the estimated expenditure upon the works; the bulk of the work will be carried out in Russia.

Moscow Works Extensions.—The Electric Planning Commission has confirmed the supplementary estimates of the Moscow supply authority (Moges) for 1924-25. This increases the amount on capital reconstruction and re-equipment to 4,200,000 roubles, and that for new construction to 3,600,000 roubles.

Extensions in the Ural.—On a report from the Ural section the Electric Planning Commission has confirmed a scheme of development of the Kizeloff regional station to 26,000 kW, with the installation of transmission lines to Perm and Chusov. The expenditure is estimated at 8,472,000 roubles, of which 5,335,000 roubles will be required next year. Approval has also been given by the Commission to a scheme for the construction of the proposed Chelyabin regional station at a cost of 8,100,000 roubles, including transmission lines, of which 2,770,000 roubles will be needed in 1925-26. It has also been decided to grant a loan of 500,000 roubles to assist in the completion of the Sverdloff station by the beginning of 1926.

A Palace of Electrical Engineering.—A committee under the chairmanship of Mr. L. D. Trotsky has been formed to prepare a scheme for the establishment in Moscow of a "palace of electrical engineering" for the housing of all electrotechnical staffs—administrative, economic, technical, and scientific—and the creation of a permanent museum of electrotechnics.

The Dnieper Hydro-Electric Works.—The question of this proposed large works again came before the State Planning Commission on June 30th, when a report was presented pointing out that the solution of the problem was closely connected with many economic matters, as, for instance, the reconstruction of the mining industry in this region, transport, &c., and that the estimated expenditure on the works in the next six years would amount to 130,000,000 roubles. The Planning Commission decided to ask the Supreme Council of National Economy to prepare a report on the subject. At the same meeting consideration was given to a scheme for the construction of a hydro-electric works on the Boz-Su, which is estimated to require the sum of 3,345,000 roubles.

New Radio Stations.—The Weak Current Trust has delivered to the Radio Transmission Company the equipment for 12 radio stations which are to be erected in Kharkof, Sverdlovsk, Odessa and other towns. Next year a further 30 stations will be established in other towns for broadcasting purposes.

Trade Statistics of South Africa.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1924, has been compiled from the recently-issued official trade statistics. The figures for 1923 are added for purposes of comparison, and notes of any increases or decreases are made. It should be observed that the large decreases under "Other electrical material" are due to a more detailed classification:—

	1923. £	1924. £	Inc. or dec. £
Electrical cable and wire.—			
Total	360,000	360,000	—
From Great Britain	344,000	324,000	− 20,000
,, United States	4,000	9,000	+ 5,000
,, Germany	8,000	12,000	+ 4,000
,, Belgium	2,000	2,000	—
Batteries, primary.—			
Total	24,000	31,000	+ 7,000
From Great Britain	5,000	8,000	+ 3,000
,, United States	14,000	17,000	+ 3,000
,, Sweden	1,000	1,000	—
,, Denmark	2,000	3,000	+ 1,000
Batteries, secondary.—			
Total	50,000	58,000	+ 8,000
From Great Britain	19,000	25,000	+ 6,000
,, United States	24,000	24,000	—
Heating and cooking apparatus.—			
Total	30,000	36,000	+ 6,000
From Great Britain	17,000	23,000	+ 6,000
,, United States	7,000	8,000	+ 1,000
,, Germany	5,000	5,000	—
Insulators, porcelain.—			
Total	6,000	11,000	+ 5,000
From Great Britain	3,000	9,000	+ 6,000
,, United States	1,000	500	− 500
,, Germany	2,000	1,500	− 500
Insulators, all other.—			
Total	3,000	9,000	+ 6,000
From Great Britain	2,000	7,000	+ 5,000
Dynamos and generators.—			
Total	—	30,000	—
From Great Britain	—	24,500	—
,, Germany	—	2,000	—
,, United States	—	3,500	—
Motors.—			
Total	225,000	167,000	− 58,000
From Great Britain	122,000	88,000	− 34,000
,, United States	55,000	47,000	− 8,000
,, Germany	27,000	9,000	− 18,000
,, Holland	8,000	2,000	− 6,000
,, Sweden	11,000	14,000	+ 3,000
Transformers.—			
Total	48,000	64,000	+ 16,000
From Great Britain	36,000	51,000	+ 15,000
,, United States	8,000	8,000	—
,, Germany	2,000	4,000	+ 2,000
Meters, electric.—			
Total	*	33,000	—
From United Kingdom	*	18,500	—
,, Germany	*	10,000	—
,, United States	*	4,000	—
Electric hand lamps.—			
Total	†	7,000	—
From United Kingdom	—	1,500	—
,, Germany	—	2,000	—
Other electric lamps, globes, bulbs, &c.—			
Total	112,000	112,000	—
From United Kingdom	49,000	37,000	− 12,000
,, Austria	9,000	4,000	− 5,000
,, Germany	10,000	11,000	+ 1,000
,, Holland	20,000	25,000	+ 5,000
,, United States	18,000	30,000	+ 12,000
Electrical machinery, other.—			
Total	169,000	554,000	+385,000
From Great Britain	121,000	365,000	+244,000
,, United States	23,000	101,000	+ 78,000
,, Germany	17,000	51,000	+ 34,000
,, Sweden	2,000	3,000	+ 1,000
Electrical material, other.—			
Total	428,000	39,000	−389,000
From Great Britain	258,000	23,000	−235,000
,, United States	77,000	7,000	− 70,000
,, Japan	500	—	− 500
,, Holland	3,000	—	− 3,000
,, Germany	66,000	6,000	− 60,000
,, Switzerland	4,000	1,000	− 3,000
,, Czecho-Slovakia	6,000	—	− 6,000
Cranes.—			
Total	25,000	22,000	− 3,000
From Great Britain	23,000	19,000	− 4,000
,, United States	1,000	2,000	+ 1,000

	1923. £	1924. £	Inc. or dec. £
Elevators and lifts.—			
Total	17,000	25,000	+ 8,000
From Great Britain	16,000	24,000	+ 8,000
,, United States	—	1,000	+ 1,000
Telegraph and telephone material.—			
Total	30,000	39,000	+ 9,000
From Great Britain	20,000	17,000	− 3,000
,, Sweden	1,000	3,000	+ 2,000
,, United States	5,000	3,000	− 2,000
,, Czecho-Slovakia	1,000	2,000	+ 1,000
,, Belgium	3,000	12,000	+ 9,000
Electric lighting outfits, self-contained.—			
Total	*	8,000	—
From United Kingdom	*	5,000	—
,, United States	*	2,500	—
Wireless apparatus and parts.—			
Total	29,000	285,000	+256,000
From Great Britain	26,000	264,000	+238,000
,, United States	3,000	6,000	+ 3,000
,, Germany	—	5,000	+ 5,000
Tramway rails.—			
Total	22,000	14,000	− 8,000
From Great Britain	16,000	14,000	− 2,000
,, United States	6,000	—	− 6,000
Tramway rolling-stock.—			
Total	24,000	25,000	+ 1,000
From Great Britain	12,000	11,000	− 1,000
,, United States	12,000	14,000	+ 2,000
Other tramway materials.—			
Total	23,000	55,000	+ 32,000
From Great Britain	17,000	45,000	+ 28,000
,, United States	5,000	9,000	+ 4,000
Pumps.—			
Total	87,000	105,000	+ 18,000
From Great Britain	50,000	60,000	+ 10,000
,, United States	24,000	28,000	+ 4,000
,, Switzerland	6,000	10,000	+ 4,000
,, Germany	5,000	4,000	− 1,000
Engines, oil, petrol and spirit.—			
Total	40,000	57,000	+ 17,000
From Great Britain	30,000	50,000	+ 20,000
,, United States	5,000	4,000	− 1,000
,, Germany	2,000	1,000	− 1,000
,, Sweden	1,500	1,000	− 500
Engines, other.—			
Total	134,000	50,000	− 84,000
From Great Britain	126,000	45,000	− 81,000
,, United States	2,000	1,500	− 500
,, Germany	5,000	1,000	− 4,000
Leather driving belts.—			
Total	41,000	47,000	+ 6,000
From Great Britain	21,000	27,000	+ 6,000
,, France	3,000	4,000	+ 1,000
,, United States	16,000	14,000	− 2,000
Other driving belts.—			
Total	120,000	135,000	+ 15,000
From Great Britain	67,000	70,000	+ 3,000
,, Canada	13,000	28,000	+ 15,000
,, United States	38,000	36,000	− 2,000

In addition to the above the following goods were imported as "Government stores":—

Batteries, primary.—			
Total	4,000	1,500	− 2,500
From Great Britain	2,000	1,200	− 800
Batteries, secondary.—			
Total	1,000	5,000	+ 4,000
From Great Britain	200	4,500	+ 4,300
,, United States	200	—	− 200
,, Germany	—	500	+ 500
Heating and cooking apparatus.—			
From Great Britain	150	300	+ 150
Insulators, porcelain.—			
Total	6,000	7,500	+ 1,500
From Great Britain	2,000	1,600	− 400
,, United States	4,000	4,000	—
Insulators, other.—			
Total	3,000	15,000	+ 12,000
From United Kingdom	2,500	1,000	− 1,500
,, United States	500	14,000	+ 13,500
Motors and parts.—			
Total	1,000	4,000	+ 3,000
From Great Britain	400	4,000	+ 3,600
,, Denmark	600	—	− 600
Transformers—			
Total	—	64,000	+ 64,000
From Great Britain	—	1,000	+ 1,000
,, United States	—	63,000	+ 63,000

	1923. £	1924. £	Inc. or dec. £
Electrical cable and wire.—			
Total	174,000	201,000	+ 27,000
From Great Britain	166,000	175,000	+ 9,000
,, United States	2,000	—	− 2,000
,, Canada	6,000	22,000	+ 16,000
,, Denmark	—	3,000	+ 3,000
Telegraph and telephone material.—			
Total	122,000	270,000	+148,000
From Great Britain	82,000	210,000	+128,000
,, United States	13,000	10,000	− 3,000
,, Sweden	27,000	30,000	+ 3,000
Electrical machinery, other.—			
Total	11,000	1,139,000	+1,128,000
From Great Britain	11,000	1,005,000	+994,000
,, United States	—	121,000	+121,000
Electrical material, other.—			
Total	239,000	—	−239,000
From Great Britain	190,000	—	−190,000
,, United States	47,000	—	− 47,000

* Included with "Material and fittings, other."
† Not previously specified.
‡ Included with "Electrical machinery, other."

Corrosion at Switch Terminals.

A Research into the Causes of Corrosion.

INVESTIGATIONS have been made recently by the Research Laboratories of the General Electric Co., Ltd., into the causes of the corroding of tumbler-switch terminals, &c. A report of the work carried out in making the investigations and the conclusions arrived at will prove of considerable interest. Visits to installations and laboratory tests prove that corrosion only occurs where the installation is wired on the negative side of a 3-wire d.c. system. The experiments also show that corrosion only becomes evident when the switches are located in a damp situation, and that the moisture is drawn to the switch terminals by the capillary action of the

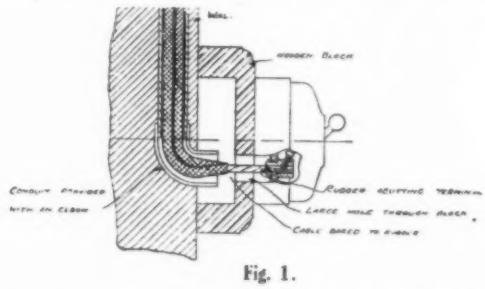

Fig. 1.

outer braiding of the cable. Leakage is set up and electrolytic action takes place, with the result that copper is deposited on the negative terminal, which in air, turns to copper carbonate and thus forms a porous covering of a salt, which tends always to keep the surface wet, thus spreading the trouble. As the blades of the switch become wet the solution is splashed on to the cover of the switch when the switch is operated. Experiments were conducted with the bare ends of the cables well greased before insertion in the switch terminals, and only

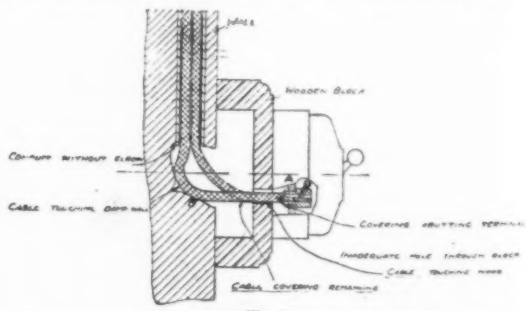

Fig. 2.

slight corrosion was observable. Further experiments were carried out under exactly similar conditions, with the exception that the outer covering of the cable was bared down to the rubber insulation for some distance before insertion in the switch, so that it could not possibly touch the metal of the switch terminals. It was then found that corrosion did not occur. Switches mounted on the positive side of the system are not subject to this trouble. A film of high resistance is formed on the metal of the positive pole which speedily causes

the cessation of the leakage current, hence the absence of corrosion.

To summarise the matter, it is apparent that the trouble is caused by the wiring of the switches in such a way that the outer braiding, in contact with water from the damp wall (B, fig. 2), is brought right up to the base of the switch terminal (A, fig. 2).

The only remedy is good and careful installation. If the position of the switch is such that the wall and surroundings are damp, the following precautions should be taken: Cables should not touch the damp wall on their way from the conduit to the switch, and a large enough cavity or the protection afforded by an elbow joint in the conduit should be provided behind the switch in order to ensure this; they should be bared down to the rubber for some inches before entering the back of the switch; and the ends of the cable should be covered in thick grease before being inserted into the switch.

This subject is of considerable importance, especially in view of the large number of new houses being erected to-day, and it is hoped that the suggested precautions for overcoming the corrosion trouble will be adopted.

Although tumbler switches only are dealt with, it will be evident that exactly the same conditions may be met with in such other accessories as fuseboards, wall plugs, cutouts, &c., and although these are not called upon to give a mechanical performance as is the case with switches, it is important that for the sake of their lasting properties and electrical efficiency similar care in installing them should be exercised.

The two diagrams given show the correct and incorrect methods of installing a tumbler switch.

We are reminded of the necessity for protection against the creeping of moisture along the conductor itself, and it will be remembered that we drew attention to the importance of this in our issue of February 20th last when we advocated the sealing of cable ends.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Adjustable Wire Stripper.

What should prove of value to the electrical wireman is a wire stripper, described in *Electrical Merchandising*, which is being manufactured by Mr. A. LAUBSCHER, 77, Fort Pleasant, Avenue, Springfield, Mass., known as the Acme electric cord

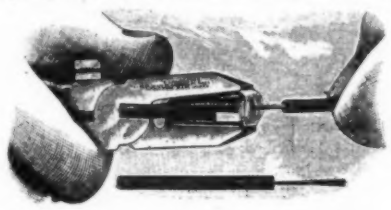

Fig. 1—Cord and Wire Stripper.

and wire stripper, fig. 1. It is claimed that it will strip double or reinforced cord as well as single. It is possible to set the stripping opening to the size necessary to accommodate the wire. All the parts are interchangeable, and may be easily removed and replaced.

A New Ironclad Switch.

The MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham, has introduced a new series of switches under the trade name of "Memrex." It is claimed that it is the first commercial ironclad switch to comply with No. 67 of

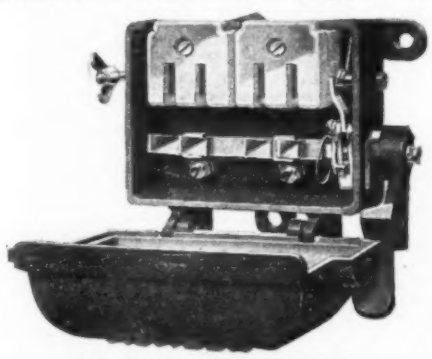

Fig. 2.—The "Memrex" Switch.

the new I.E.E. Regulations, which specifies tests of 50 per cent. excess current at 50 per cent. excess pressure over rating. The switch is fitted with the M.E.M. quick-make-and-break movement, and special attention is drawn to the complete shrouding of the live parts, which enables the switch to comply with the strictest interpretation of the Home Office Regulations. Standard "Memrex" switches have been tested at the Birmingham University Electrical Laboratory under the following conditions, with satisfactory results: a 15-A switch was tested on a load of 22.5 A, a 30-A switch on 45 A, and a 60-A switch on 90 A, all at a pressure of 750 V. Fig. 2 shows the "Memrex" switch, which can also be supplied as a combination switch and fuses.

A Fusible Cartridge for use with an Electric Iron.

A somewhat ingenious device, designed for use in conjunction with their "Safe Economy" electric iron, has been marketed by MESSRS. IMPROVED APPLIANCES, LTD., 43-4, Fetter Lane, London, E.C.4, in the form of a collapsible cartridge designed to hold the switch of the iron "on" for a given period and then release it automatically. It consists of two cylindrical metal tubes, one inside the other, fixed, when cold, at a

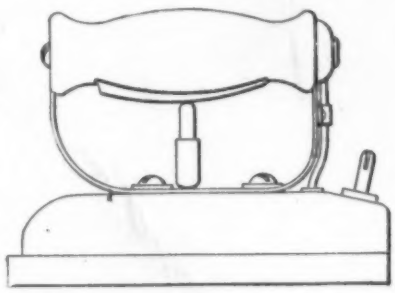

Fig. 3.—Fusible Cartridge in Position.

point giving the required length to hold the switch "on." The cartridge is placed vertically between the switch handle and the element case, as in fig. 3. At a certain temperature or after a period of about 10 minutes the grip between the two portions is released, with the result that the device collapses and the switch is released from the "on" position by its own mechanism.

A New Portable Electric Cylinder Boring Machine.

A description is given in the *Railway Gazette* of a recent product of MESSRS. BEYER, PEACOCK & CO., LTD., 15, Dean's Yard, Westminster, London, S.W.1, in the form of a portable electric cylinder-boring machine, fig. 4. This device consists of a mild steel bar of 4¼ in. diameter, carrying the boring head and mounted in bearings in the main frame. This is designed as an oil-tight gear-box and is fitted with a 2-speed gear for driving the main worm wheel mounted on the bar which can be started, stopped and varied in speed by means of an operating

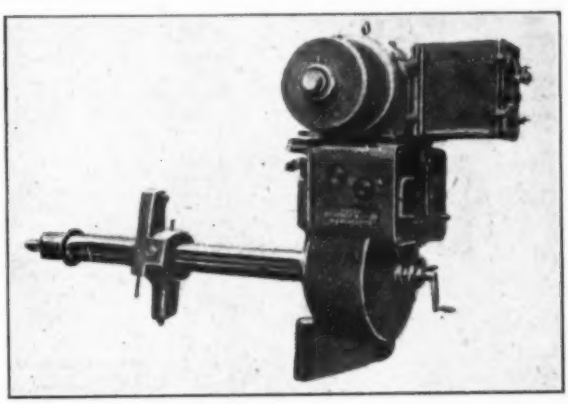

Fig. 4.—A New Electric Portable Boring Machine.

lever without stopping the motor. The machine is driven at constant speed by a 1-h.p. motor mounted on the main frame and carrying the starter on the side. An isolating switch is also provided, together with the necessary plugs, sockets and cable. The equipment comprises two boring heads and sets of tools, one pair of sample adaptors for bolting to the cylinder cover face and the necessary adjusting tools.

By bolting the machine to the adaptors and fitting the boring bar with the bush in the stuffing box of the rear cylinder cover, the machine is rendered self-centring.

A Combined Electric Towel Airer and Radiator.

The accompanying illustration, fig. 5, is of the "Gee-Gee" combined towel airer and radiator, a recent product of MESSRS. GEO. GREEN & CO., 40, Aybrook Street, Manchester Square, London, W.1. It is designed to give efficient service in the bathroom in both of the directions indicated, and is claimed to take up no more room than an ordinary towel rail. The

radiator is of the electrically-heated-water-type, and is equipped with a "Gee-Gee" immersion heater; this is arranged for 3-heat regulation. The maximum loading of 750 W is claimed to be sufficient to heat a bathroom of the

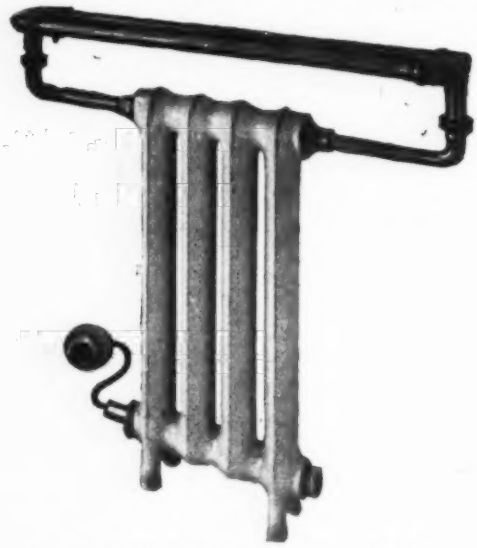

Fig. 5.—Combined Electric Towel Airer and Radiator.

usual dimensions, medium or low switching being used for airing purposes during warm weather.

The combination is finished with polished gun-metal rails and white enamelled radiator.

A Wiring System for Fume-laden Atmospheres.

The "Helsby" Ebonite-Enclosed Wiring System.

The advent of a system of electrical wiring that offers protection against the corrosive conditions obtaining in chemical factories, bleach yards and similar establishments will be welcomed by engineers whose work brings them in touch with conditions where lead or rubber sheathed cables, metal boxes and fittings will not stand up to the action of fumes, &c.

That ebonite is the strongest resistant to corrosive action commercially marketed is the basis on which the British Insulated & Helsby Cables, Ltd., has introduced the "Helsby" ebonite-enclosed wiring system. This consists of a range of cables and fittings completely enclosed in ebonite. The cable is supplied as single, two or three core, Association 600-megohm

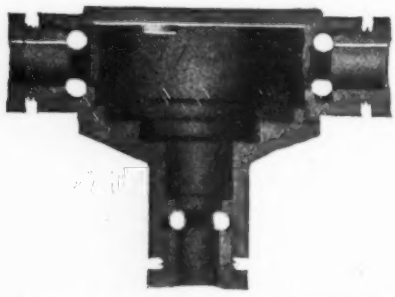

Fig. 1.—Section of Ebonite Case for Ceiling Rose.

grade, insulated with pure and vulcanised rubber and sheathed with a substantial tube of ebonite, all sizes, whether single or multi-core, being built up to an external diameter of half an inch. Only one size of gland is therefore necessary, although the makers have produced a smaller gland for use with flexible suspension lamp fittings, where cab-tire-sheathed twin flexibles may be used. The finished ebonite-sheathed cable is very strong and rigid when erected, and it is claimed that the ebonite sheathing affords mechanical protection to the insulated cores almost comparable to steel conduit.

The fittings, such as connectors for making joints, switches, fuse boards, &c., are enclosed in cylindrical ebonite boxes, in such a way that no metal parts are exposed to the atmosphere. The boxes are provided with screw glands, with rubber packing washers, making gas and watertight joints with the cable surface. The joint boxes are made in two, three and four ways, and gland plugs can be supplied for closing the ways not required. The ceiling rose embodies the same type of gland and screw-on cover as the joint boxes, an internal device preventing the weight of the pendant cable and lamp-holder from straining the joint.

In fig. 1 is shown a section of an ebonite fitting in the form of a ceiling rose.

Two types of lamp holder are provided suitable for vacuum lamps. One of these is intended for use with cab-tire-sheathed pendant cable, where it is desired to have flexible pendants. It comprises a standard brass bayonet socket cord grip lamp-holder enclosed in an ebonite shroud; the shroud is in two parts, enabling the holder to be easily wired. The other type of holder has an arrangement similar to the ceiling rose for taking the weight of the fitting.

Distribution boards or boxes are built up in a similar manner to the other fittings, the fuse elements being enclosed in an ebonite box fitted with cable glands. Fig. 2 shows a 4-way d.p. board, approximately a quarter of the actual size. The other necessary fittings including watertight rotary snap switches are all built up on the same principle.

By virtue of the property of ebonite of softening under heat, the sheathed cable is wound into coils of about 3 ft. 6 in. external diameter. It is, of course, necessary to again heat the cable before it can be uncoiled, a convenient method of doing this being to immerse the coil in hot water for a few minutes. When the sheathing becomes soft enough the cable is straightened out into the lengths required and as it becomes cold it hardens again. During erection it may be easily bent to any radius by heating locally at the required point; when set it permanently retains the curvature it has been given. It is claimed that the cutting of the cable and the preparation of the ends is quite simple. A slight incision made with a knife completely round the circumference enables the ebonite to be cracked on being sharply bent, when the cable inside

Fig. 2.—Ebonite Case for Distribution Board.

may be severed in the ordinary way with cutting pliers. To prepare the ends the sheath is cracked in the same manner and the piece drawn off.

The system has been subjected to severe practical tests, and some particulars from a report on an installation wired with the system are of great interest. The installation is at the works of a firm of bleachers, mercerisers and dyers. The mills were wired with the ebonite-enclosed wiring system in 1922 and no trouble has yet arisen on the installation, consisting of some 20 h.p. and over 100 lighting points. All departments are wired, including the various dyehouses, bleaching, mercerising, and stoving rooms, where the moisture-laden atmosphere is charged with chemical fumes, and water spraying, splashing, and dipping (slightly acid or alkaline) takes place, rendering the ordinary systems of wiring unsuitable. The whole of the wiring is said to be in as good condition to-day as when it was erected. The connections to the motors are run down the walls, along the floors and in some cases along the dyeing machines themselves, where they are continually subjected to hot and cold chemically charged liquors.

Electrical Train Shunting.—A new car retarding device to eliminate "car riding" and "switching tending," two of the most hazardous kinds of railroad work, was recently demonstrated at Gary, Ind., railway officials representing several roads being present. The new contrivance enables a tower operator to regulate the speed of a car and guide it to the correct track by electric lever switches. The invention was designed jointly by Messrs. George Hanhaner, vice-president of the Indiana Harbour Belt Railroad, and E. M. Wilcox, master technical engineer, and is controlled by them. The Illinois Central Railway has contracted to install the appliance in its yards at Harvey, Ill., and the New York Central Railroad had a representative at the demonstration, with the view of using the invention in its yards near Albany, N.Y.—*Reuter's Trade Service* (Chicago).

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Regulations for Rural Overhead Lines.

Recently, the chairman of a British electric power supply company stated that the cost of connecting a farm to its lines was £300. Just about that time, an Italian engineer complained to the writer that he could not get the cost of switchgear for tapping a 33,000-volt line below £14. These cases are obviously extreme, but there must be a reasonable intermediate solution, preferably rather nearer the lower figure.

Many engineers complain about the present overhead line regulations that exist in this country. However, looking at them from the point of view of absolute safety and uninterrupted continuity of service between central stations and important towns, it would seem that they are not really very far wrong. For a rural service, periodical brief cessations of supply for inspecting and repairing purposes can be permitted. In fact, it is the usual practice on the Continent to close down all overhead networks for a few hours each Sunday morning even though it may stop a few electric church organs, and put out a few cellar lights.

In your editorial for August 28th, in commenting upon the recommendations of the Electricity in Agriculture Committee of the Institution of Electrical Engineers, you expressed the hope that no further obstacles would be placed in the way of rural electrification. With this hope I am in entire agreement. My difficulty is, however, to see how best the end can be attained of installing suitable rural lines in a safe and economical way in this country, without offending official regulations. Further, very few engineers here seem to have studied this work in detail, hence considerable guidance is needed in addition, or else overhead lines that err too much on the side of cheapness and nastiness may be erected. Perhaps some of your readers could put forward suggestions as to the best way to solve the problem of stipulating minimum reasonable requirements, as a matter entirely apart from the present overhead-line regulations.

R. Borlase Matthews.

East Grinstead, *September 2nd*, 1925.

Legal.

S. G. Brown, Ltd., v. The National Association of Radio Manufacturers and Traders.

THIS case came before Mr. Justice Finlay in the Vacation Court on September 1st. Mr. Jowitt, K.C., Mr. Haydon, K.C., and Mr. Jacobs appeared for Messrs. Brown, and Sir H. Slesser, K.C., and Mr. Steinham for the Association.

Mr. JOWITT stated that the matter was a very serious one. In the first place, plaintiffs were asking for an injunction restraining the Association from including the plaintiffs' name in the Association's "stop list." Secondly, the plaintiffs sought a sequestration order on the ground that the Association had failed to comply with an injunction granted by Mr. Justice Acton restraining it from excluding the plaintiffs from the Wireless Exhibition to be held at the Albert Hall this month. Counsel declared that the Association had so manœuvred as to make it unnecessary for it to grant Messrs. Brown any space at all. The Association was a trade union and Messrs. Brown were well-known manufacturers of all sorts of wireless instruments. Among the rules governing the relationship of the members *inter se* and of the members with the corporate body were rules that the Association was to support and uphold any "stop list" issued by the manufacturers' section; and that there should be 21 days' notice and an opportunity of being heard given to any member before his expulsion from the Association. On May 14th last the plaintiffs received a notice that an emergency meeting of the manufacturers' section would be held on May 20th. There was nothing in the agenda of that meeting to indicate that the business would in any way affect the plaintiffs, although there was one item marked "Price-cutting, to receive correspondence." On the day before the meeting the plaintiffs' secretary was informed by the secretary of the Association that charges would be made against Messrs. Brown. The plaintiffs' secretary said he could not attend and asked for particulars of the charges. These were refused. At the meeting a resolution was passed that the executive was satisfied that Messrs. Brown had committed a breach of the Association's by-laws in giving irregular discounts to retailers and that Messrs. Brown were to be fined £525. It was also resolved that if a satisfactory explanation was not given by a certain date Messrs. Brown would be put upon the official "stop list." Counsel contended that such a resolution could not possibly have any validity in the circumstances for it was made in the absence of the plaintiffs and before they had been given any opportunity of being heard. Plaintiffs refused to recognise the validity of the resolution and their solicitor wrote demanding that the fine be rescinded. Unless this was done he refused to give the plaintiffs' explanation. Ultimately the Association gave some particulars of the irregularities alleged. These the plaintiffs considered "trumpery," and they gave notice of their intention to withdraw from the Association. The manufacturers' sectional executive met again on July 17th and on July 23rd the plaintiffs' name was put upon the Association's official "stop list" for the first time. The Association's secretary also sent a circular to the members pointing out the fact. Counsel said he had evidence showing that the damage done to the plaintiffs by the "stop list" was a continuing one.

SIR H. SLESSER said his submission would be that the proceedings were altogether bad. The Association had not in fact acted upon the resolutions of the meeting in May. The fine had not been pressed and a fresh start in the matter was made by a fresh resolution properly in order on July 17th.

Mr. JOWITT argued that subsequent events could not be divorced from the earlier steps. The conduct of the Association was throughout tainted with the illegality of the proceedings on May 20th.

The hearing was continued on September 3rd, when Mr. JOWITT, proceeding with his opening statement, said that he had now received some documents from the other side which, in his submission, proved that the resolution of July 17th could not stand on its own legs, but owed any validity it had to the meeting of June 22nd. At the meeting of June 22nd the sectional executive body resolved, as Messrs. Brown had failed to comply with the resolution of May 20th, to place them on the "stop list," and appointed a special "disciplinary committee" from the executive to meet on June 30th and hear whatever explanations Messrs. Brown, who were requested to attend, should make with regard to the charge made against them of granting irregular discounts. Messrs. Brown refused to attend or make any explanations unless the resolution of May 20th, imposing the fine, was rescinded and the *status quo ante* was restored. Counsel contended that in order to have a reasonable opportunity of explaining, Messrs. Brown wished to go before the Committee as innocent persons and not as persons who had been prejudged and fined. The special Committee adjourned until July 17th, when the resolution in question was passed, which, counsel urged, the Committee had no power to pass.

Sir HENRY SLESSER said there was a meeting of the whole executive body on July 24th, when the action of the Committee in placing Messrs. Brown on the "stop list" was approved and confirmed.

His LORDSHIP said that, subject to anything Sir Henry Slesser had to say, he thought the real date with which they had to deal was June 22nd.

Sir HENRY SLESSER said he would deal with the two matters of injunction and sequestration separately, as they were fundamentally different. In the case of the injunction he submitted with confidence that this was really an attempt to reopen a matter which had been fully considered by Mr. Justice Acton. Nothing had happened since that time to justify the Court in doing so. It was a very serious request to make, and entirely contrary to the practice of the Court.

His LORDSHIP: I am disposed to agree if nothing new has happened, and Mr. Justice Acton had all the materials before him.

Sir HENRY SLESSER said that nothing new had happened, except the publication in a trade paper of the addition of Messrs. Brown to the "stop list." The plaintiffs alleged that the breaches of the Association's rules complained of were trumpery and easily explained. The Association, on the other hand, thought that what was done by Messrs. Brown constituted serious breaches of the rules and seriously menaced the standard rates which the Association existed to protect.

His LORDSHIP said he could not decide that.

Sir HENRY SLESSER said that Mr. Justice Acton had before him not only evidence of general financial damage as the result of placing Messrs. Brown on the "stop list," but also evidence of specific financial damage. The most, therefore, that the plaintiffs could say was that they had now adduced more evidence on that point. Until July 17th there was no operative resolution to put Messrs. Brown on the "stop list," and quite apart from whether that resolution might be connected with the previous fining resolution, he submitted that on July 3rd the plaintiffs received adequate notice to attend the meeting and full particulars of the charges to be made. Consequently there was nothing here contrary to natural justice because the plaintiffs did not choose to attend.

His LORDSHIP: They had been fined for the very things that were to be inquired into at the meeting.

SIR HENRY SLESSER: No, I submit not. In May it might have been said that there was no power to fine at all. Secondly, it might have been said that no notice had been given of the charges, and therefore the proceedings were contrary to natural justice. He did not attack or defend what was done in May. That was the subject of further litigation. The point was that at the meeting in June there was no longer any attempt to fine Messrs. Brown, but to put them on the "stop list." Therefore, the first criticism of the May resolution disappeared and the second criticism went by the board also immediately it was seen that adequate notice of the June meeting had been given. In any case an injunction would not be effective as the Association could convene another meeting and properly place the plaintiffs on the "stop list" if they were not properly there now. With regard to sequestration, Sir Henry declared that the Association had not disobeyed the order of Mr. Justice Acton, and had not the least desire to do so. It had done what the Judge intended it to do, and nothing more nor less. It was not to exclude the plaintiffs from the Wireless Exhibition. That did not mean that it was to allot them a stand. The Association was to grant the plaintiffs an equal

opportunity with other members to make an application for a stand, that was all.

His LORDSHIP said that the wording of the order was singularly inoperative, but he felt that it was the intention of Mr. Justice Acton that the plaintiffs should have a stall at the Exhibition. He suggested that there should be no order with respect to the alleged contempt, but that he should now direct the Association to provide the plaintiffs with a stall.

Sir HENRY SLESSER said that the members had no right to all to any space at the Exhibition. Such space allocation was contingent upon the acceptance of a contract. There was no obligation upon the Association to provide space for anybody in particular.

After a lengthy consultation the parties arrived at a settlement of the whole dispute.

Mr. JOWITT stated that the terms were that the defendants agreed to reinstate the plaintiffs forthwith as full members of the Association, the plaintiffs' resignation to stand, but not to be operative until September 27th; the defendants withdrew all charges against the plaintiffs on the plaintiffs' agreeing that the defendants' action in placing them on the "stop list" was taken in good faith; the plaintiffs admitted the moral obligation to abide by the rules of the Association; the defendants agreed to allot a stand to the plaintiffs at the forthcoming exhibition; the defendants agreed to withdraw plaintiffs' name from the "stop list" and delete the resolution with regard to the fine; the record of these proceedings to be withdrawn, and all claims by the plaintiffs to be abandoned, each party paying its own costs. Beyond the publication of these terms both parties agreed not to make any public announcement with regard to the matters in dispute; and the defendants agreed not to place the plaintiffs on the "stop list" by reason of their ceasing to be members of the Association.

His LORDSHIP considered that the parties had taken a very wise course.

British Broadcasting Co., Ltd., v. Wireless League Gazette Publishing Co., Ltd.

THE British Broadcasting Co., Ltd., on September 2nd, in the Vacation Court, applied for an interim injunction restraining until the trial of the action the Wireless League Gazette Publishing Company, Ltd., from infringing its copyright in the *Radio Times* by publishing on Saturdays the substance of the coming week's broadcasting programmes. For the defendants it was contended that there was no copyright and that there was nothing in the contract between the Postmaster-General and the British Broadcasting Company which entitled the company to exploit the programmes for its own profit.

Mr. JUSTICE FINLAY said he was not satisfied that the defendants were right and would ultimately succeed, but he was satisfied that there were serious and difficult questions of copyright to be tried. In the circumstances there would be no order on the motion except that the costs should be made costs in the action and that facilities would be given for an early trial of the action.

Globe & Sampson, Ltd., v. T. W. & R. C. Globe.

AT the Sheffield County Court recently, Globe and Simpson, Ltd., magneto specialists, of Cambridge Street, Sheffield, sued Thomas Wilson Globe and Reginald Cocking Globe, car electrical factors, of Broad Lane, Sheffield, for £50 damages for alleged breach of contract in connection with the sale and purchase of a business of magneto specialists and accumulator and starting battery engineers, and also for an injunction to restrain the defendants from carrying on or being connected with such business within 25 miles of Sheffield, and in particular from continuing to carry on or be connected with such business under the title of "Globe & Co.," at Broad Lane, Sheffield, as being contrary to an agreement entered into by the defendants on April 21st, 1921.

For the defendants, Mr. F. J. O. CODDINGTON said that the agreement had been cancelled at a meeting held on March 24th, 1924.

In cross-examination, REGINALD GLOBE admitted that only one clause of the agreement had been cancelled on the occasion referred to.

After a long summing up, the Judge gave judgment for the plaintiffs, awarded £2 damages, and granted an injunction. His Honour allowed a stay of execution for 14 days pending an appeal.

Japanese Electrical Exhibition.—His Majesty's Consul at Osaka (Mr. W. B. Cunningham) reports that arrangements are being made by the Kwansai (Western Japan) Branch of the Electric Association of Japan for an electrical exhibition on a considerable scale, which is to be held at Osaka from March 20th to May 31st, 1926. The promoters of the exhibition, which will be the largest of its kind as yet held in Japan, state that exhibits from foreign countries will be welcomed, although it is only in the case of Japanese goods that any awards will be offered. Applications for space are to be sent in by December 30th next and should contain full particulars of the nature of the goods to be exhibited, the space and current (if any) required, &c. They should be addressed to the office of the Exhibition, c/o Denki Kyokwai Shibu, Dojimanaka 2 chome, Kita-ku, Osaka.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken

1924.

6,227. "Wireless receiving circuits." J. Robinson and T. H. Kinman. March 11th, 1924. (238,261.)

9,034. "Thermionic generators of high-frequency electric oscillations." E. W. B. Gill and E. Green. April 9th, 1924. (Addition to 201,585.) (238,265.)

9,347. "Apparatus for recording and reproducing sound." J. R. Robertson. April 12th, 1923. (214,274.)

11,284. "Alternating-current rectifiers." L. J. Hancock and Hancock and Co. (Engineers), Ltd. May 7th, 1924. (238,276.)

11,622. "Electrical apparatus for delivering a constant output when energised by a variable alternating input." W. J. Brown and Metropolitan-Vickers Electrical Co., Ltd. May 10th, 1924. (Cognate Application, 6,381/25.) (238,281.)

11,792. "Variable inductances for wireless telephony and the like." F. Noble. May 13th, 1924. (238,270.)

12,307. "Sound reproducers." P. G. A. H. Voigt. May 20th, 1924. (Cognate Application, 1,578/25.) (238,310.)

12,722. "Inductance coils." Igranic Electric Co., Ltd., A. H. Curtis, L. E. Currah, and W. K. Alford. May 23rd, 1924. (238,318.)

12,939. "Apparatus adapted for wireless reception." E. A. Graham. May 26th, 1924. (238,323.)

13,098. "Electric heaters." J. Schoenfeld. May 28th, 1924. (238,325.)

14,242. "Reproducing amplifiers for sound or like waves." T. W. Case. June 12th, 1924. (238,333.)

14,714. "Electrical heating unit." O. Kitzinger, J. Pickl, M. Moser, and A. Kraus. June 18th, 1923. (217,904.)

15,272. "Electrodes for discharge tubes." British Thomson-Houston Co., Ltd. July 24th, 1923. (219,663.)

15,464. "Radio receivers." N. Lea and Radio Communication Co., Ltd. June 26th, 1924. (238,338.)

15,731. "Electric contact-makers for use on the steering wheels of vehicles." G. Rose. June 30th, 1923. (218,330.)

15,834. "Electric generator and battery protector." T. W. Sampson and W. C. Chappell. July 1st, 1924. (Addition to 215,346.) (238,339.)

16,004. "Wireless receiving apparatus." C. L. Edwards. July 3rd, 1924. (238,342.)

17,497. "Pilotless aircraft for use in war." R. E. Bozon. July 22nd, 1924. (238,352.)

17,904. "Electromagnetic interrupters for the intermittent illumination of electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). July 26th, 1924. (238,358.)

18,747. "Wireless apparatus." R. French and C. French. August 6th, 1924. (238,366.)

19,129. "Extra high tension junction boxes for multi-core electrical cables." Forges & Ateliers de Constructions Electriques de Jeumont. May 13th, 1924. (234,038.)

19,494. "Electric switches." W. Edwards. August 16th, 1924. (238,376.)

20,274. "Heat-responsive electric circuit controllers." British Thomson-Houston Co., Ltd. August 27th, 1924. (221,213.)

20,979. "Electrical switches, particularly for high-tension systems." Electric Control, Ltd., and W. J. Gilson. September 5th, 1924. (238,384.)

23,690. "Sound-reproducing apparatus." British Thomson-Houston Co., Ltd. March 27th, 1924. (231,420.)

24,157. "Damping circuits for alternating-current machines." Siemens-Schuckertwerke Ges. October 13th, 1923. (223,250.)

24,233. "Taping machines." Western Electric Co., Ltd. December 31st, 1923. (Addition to 203,297.) (227,082.)

25,164. "Electric discharge apparatus." British Thomson-Houston Co., Ltd. October 23rd, 1923. (223,921.)

26,421. "Combined manual and automatic switches for electric heaters." M. Klettner. November 5th, 1924. (238,419.)

26,513. "Electrotherapeutic appliances or apparatus." E. R. G. Greville and F. W. Read. November 6th, 1924. (238,420.)

28,783. "Starting and short-circuiting devices for induction motors." J. W. Kirkland (Allgemeine Elektricitats-Ges.). December 1st, 1924. (238,433.)

29,812. "Tuning coils for wireless apparatus." A. M. M. Poole and H. C. Poole. December 11th, 1924. (238,439.)

30,134. "Electric lift machines and the like." J. B. M. Knutsen. December 15th, 1924. (238,441.)

30,357. "Methods of sheathing electrical conductors and like cores." Western Electric Co., Ltd. (Western Electric Co., Inc.). December 17th, 1924. (238,442.)

30,647. "Intermittent electric light fitting." A. Shaw and F. Fairer. December 20th, 1924. (238,443.)

1925.

844. "Overload electric relays." British Thomson-Houston Co., Ltd., and J. Sugden. January 10th, 1925. (238,453.)

1,840. "Combined wireless valve holder and rheostat." E. Dixon and C. J. E. Dixon. January 21st, 1925. (238,459.)

2,851. "Variable resistance devices." P. C. Rushen (Pacent Electric Co., Inc.). January 31st, 1925. (238,462.)

3,751. "Electric switches." International General Electric Co., Inc. February 11th, 1924. (229,237.)

4,053. "Electrical relays." H. J. Fitzpatrick. February 13th, 1925. (238,468.)

5,684. "Electric insulators." Porcelainfabriken Norden Aktieselskabet. March 5th, 1924. (230,446.)

7,632. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. May 16th, 1924. (Divided Application on 12,136/24.) (238,477.)

7,776. "Process for electrical gas purification." Lodge-Cottrell, Ltd. (formerly Lodge Fume Co., Ltd.) (Metallbank und Metallurgische Ges. Akt.-Ges.). March 23rd, 1925. (Addition to 177,117.) (238,480.)

8,038. "Relays for the protection of alternating electric current systems." International General Electric Co., Inc. March 25th, 1924. (231,505.)

13,053. "Ignition coils for internal combustion engines." R. Bosch Akt.-Ges. June 26th, 1924. (236,181.)

15,012. "Illuminating appliances." A. J. Stephens (W. A. Durey). June 9th, 1925. (238,498.)

17,657. "Electrical heating elements." E. L. Wiegand. March 11th, 1924. (Divided Application on 221,180.) (238,502.)